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Title page

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An uncertainty spreadsheet for the k0-standardisation method in Neutron Activation Analysis

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21 Abstract

19

22 This paper focuses on the use of the spreadsheet technique to set up the uncertainty budget 23 for the k_0 -standardisation method in Neutron Activation Analysis. The adopted 24 measurement model included most of presently recognized error sources and was written 25 to limit the covariances between input quantities. The calculations were implemented in a 26 worksheet file and tested in a multi-elemental analysis of a biological material. Besides, it 27 was demonstrated that the k_0 -standardisation turns to the relative-standardisation when the 28 monitor element corresponds to the analyte element. The developed worksheet is available 29 and suitable for the analysis of other materials in different experimental conditions.

30 Keywords

 k_0 -standardisation method, uncertainty budget, spreadsheet technique, correlated input quantities, cerebrospinal fluid

33 Introduction

In 1995, a guide was published by EURACHEM/CITAC [1] to illustrate the use in chemistry measurements of the general rules outlined in the Guide to the Expression of

Uncertainty in Measurement (GUM) [2] for the evaluation and expression of uncertainty.
Afterwards, since specific applications in nuclear chemistry measurements were missing
in the guide, practical examples for the most common nuclear analytical techniques were
included in a report of the International Atomic Energy Agency (IAEA) [3].

40 The Neutron Activation Analysis (NAA) was addressed in the IAEA report, as regards the 41 existing standardisation methods, i.e. the relative- and k_0 -NAA. A detailed list of sources 42 of error were identified and grouped in four categories: i) preparation of samples, ii) 43 neutron irradiation, iii) *y*-spectrometry measurements and iv) radiochemical separation, if 44 executed. Two uncertainty budgets were given as examples for the relative-NAA, the first 45 dealing with vanadium in coal fly ash by Instrumental NAA (INAA) and the latter with 46 manganese in animal freeze dried blood by Radiochemical NAA (RNAA). Only one 47 example for the k_0 -NAA was cited, with a reference to the (preliminary) evaluation 48 performed by de Corte [4].

49 Next, several studies focused on the k_0 -NAA. Robouch et al [5] suggested the use of the 50 spreadsheet technique developed by Kragten [6] and recommended a general equation to 51 express the uncertainty of the results. Younes et al [7] showed that the sensitivity 52 coefficients, computed by finite difference approximations in the spreadsheet technique, 53 could also be expressed in analytical form. In fact, subsequent works were all based on 54 analytical expressions of the sensitivity coefficients [8, 9].

To date, the most comprehensive examples of uncertainty budgets for k_0 -NAA were reported in [9] and concerned the determination of Au, Cr, Rb and Sb in compressed cellulose pellets. The covariances between input quantities, in practice always neglected in the previously available literature, were to some extent considered. However, values and expressions of correlation and sensitivity coefficients were omitted.

In this study, we adopted a measurement equation modeling most of the acknowledged sources of error and written to limit the covariances. Due to the complexity of the resulting functional relationship, we used the spreadsheet technique and the matrix formalism to propagate the uncertainties, including the outstanding correlations. The formulae were implemented and tested for the determination of trace elements in a biological material.

Details on the neutron activation experiment as well as on the characterization of the detection system are here presented to assign estimates, uncertainties and correlation coefficients of the input quantities. Lastly, the uncertainty budgets are briefly discussed to point out the main contributors to the combined uncertainties of the results.

69 Model

84

The theoretical basis of k_0 -NAA is well established and extensively reported in literature. Simonits et al. proposed the original idea in 1975 [10] following a preliminary study carried out by Girardi et al. [11]. In 1987, de Corte published the most comprehensive development of the method [4], including references to previous papers focused on definitions and assumptions of the standardisation. Here, the basic concepts are briefly recalled to term the input quantities of the measurement model.

The formalism underlying the method is based on a rather simple description of the reaction rate per target nuclide, *R*, following the Høgdahl convention [12] in the case of a (target) nuclide having a $1/E^{1/2}$ dependence of the (n, γ) cross section function, $\sigma(E)$, versus the neutron energy, *E*.

According to the convention, the neutron spectrum is divided in the sub- and epi-cadmium regions, respectively below and above the cadmium cut-off energy fixed to 0.55 eV. The fission component is neglected under the hypothesis that the corresponding contribution to *R* is small. Accordingly:

 $R = G_{\rm th} \Phi_{\rm s} \sigma_0 + G_{\rm e} \Phi_{\rm e} I_0(\alpha), \tag{1}$

where $\Phi_{\rm s}$ and $\Phi_{\rm e}$ are the (conventional) sub- and epi-cadmium neutron fluxes, $G_{\rm th}$ and $G_{\rm e}$ are correction factors accounting for the thermal and epithermal neutron self-shielding, σ_0 is the thermal cross section, and $I_0(\alpha)$ is the resonance integral for a $1/E^{1+\alpha}$ neutron spectrum in the epi-cadmium region.

The knowledge of the time dependence of the amount of produced radionuclide during and
after activation combined to the counting of the emitted *p*-photons links the number of

91 target nuclides in a sample, N_t , to the number of counts in the full-energy peak of the 92 collected γ -spectrum, n_p , via R.

With the exception of branching activation and mother-daughter decay, and neglecting burn-up effects, the relation between N_t and n_p is:

95
$$R N_{t} \varepsilon_{p}^{\text{geo}} P_{\gamma} = \frac{\lambda n_{p} \left(\delta \xi / \text{COI}\right)}{\left(1 - e^{-\lambda t_{i}}\right) e^{-\lambda t_{d}} \left(1 - e^{-\lambda t_{c}}\right)}, \qquad (2)$$

where R N_t is the total reaction rate, $\varepsilon_p^{\text{geo}}$ is the full-energy γ -peak detection efficiency for 96 the actual position and geometry of the sample, P_{γ} is the absolute emission probability of 97 the γ -photons, t_c and t_l are the counting and live times of the detection system, t_i is the 98 99 irradiation time, t_d is the decay time after irradiation, COI is the true-coincidence correction factor, $\lambda = \ln(2) / t_{1/2}$ is the decay constant of the produced radionuclide, given 100 its half-life $t_{1/2}$, $\delta = t_c/t_l$ is the dead time correction factor and $\xi = e^{\mu(1-t_l/t_c)}$ is the 101 excess counting loss correction factor, given the excess counting loss constant of the 102 103 detection system, μ , defined in [13].

104 In the case that the (target) nuclide is an isotope of an element in a *m* mass sample, N_t can 105 be expressed as:

$$N_{\rm t} = \frac{w \, m \, x \, N_{\rm A}}{M},\tag{3}$$

107 where *x* is the abundance of the isotope, N_A is the Avogadro constant, and *w* and *M* are the 108 mass fraction and molar mass of the element in the sample, respectively.

109 From eqs. (1), (2) and (3), it follows:

110
$$\frac{\sigma_0 P_{\gamma} x N_A}{M} = \frac{\lambda n_p \left(\delta \xi / \text{COI}\right)}{\left(1 - e^{-\lambda t_i}\right) e^{-\lambda t_i} \left(1 - e^{-\lambda t_c}\right) \varepsilon_p^{\text{geo}}} \frac{1}{m w} \frac{1}{\phi_s \left(G_{\text{th}} + \frac{G_e Q_0(\alpha)}{f}\right)}, \tag{4}$$

111 where $Q_0(\alpha) = I_0(\alpha)/\sigma_0$ and $f = \Phi_s/\Phi_e$. The $Q_0(\alpha)$ value is obtained by applying the 112 formula $Q_0(\alpha) = (Q_0 - 0.429)\overline{E}_r^{-\alpha} + 0.429/[0.55^{\alpha}(1+2\alpha)]$, where $Q_0 = I_0/\sigma_0$ is the

- 113 ratio of the resonance integral (for a 1/E neutron spectrum in the epi-cadmium region) to
- 114 the thermal cross section and \overline{E}_r is the effective resonance energy of the target nuclide.
- 115 It is worth remarking that the parameters on the left-hand side of (4) are independent of the
- 116 experimental conditions of irradiation and γ -counting. In fact, the product $\sigma_0 P_{\gamma} N_A$ is a
- 117 constant quantity and the ratio x/M depends on the isotopic composition.
- 118 The k_0 -NAA measurement model is derived from the application of (4) to the element to
- be quantified, i.e. the analyte, and to an element used as a monitor of the of the neutronfluence rate.
- 121 The following equation holds under the assumption that analyte and monitor are exposed 122 to the same (constant) values of Φ_s and Φ_e during the irradiation:

123
$$w_{a} = \frac{\frac{\lambda n_{p} \delta \xi}{\left(1 - e^{-\lambda t_{i}}\right)e^{-\lambda t_{d}}\left(1 - e^{-\lambda t_{c}}\right)}}{\frac{\lambda n_{p} \delta \xi}{\left(1 - e^{-\lambda t_{i}}\right)e^{-\lambda t_{d}}\left(1 - e^{-\lambda t_{c}}\right)}} \frac{k_{0 Au}(m)}{k_{0 Au}(a)} \frac{\left(G_{th m} + \frac{G_{e m} Q_{0 m}(\alpha)}{f}\right)}{\left(G_{th a} + \frac{G_{e a} Q_{0 a}(\alpha)}{f}\right)} \frac{\varepsilon_{p m}^{geo}}{\varepsilon_{p a}^{geo}} \frac{\text{COI}_{m}}{\text{COI}_{a}} \frac{m_{m}}{m_{a}} w_{m}, \qquad (5)$$

124 where the parameters $k_{0 Au}(m) = \frac{M_{Au} \sigma_{0 m} P_{\gamma m} x_m}{M_m \sigma_{0 Au} P_{\gamma Au} x_{Au}}$ and $k_{0 Au}(a) = \frac{M_{Au} \sigma_{0 a} P_{\gamma a} x_a}{M_a \sigma_{0 Au} P_{\gamma Au} x_{Au}}$ are the 125 so-called k_0 factors; subscripts a and m refer to the analyte and to the monitor, respectively. 126 The k_0 values have been experimentally determined for the most important (n, γ) reactions 127 and γ -photons energies with respect to the 411 keV γ -photons emitted by ¹⁹⁸Au produced 128 from ¹⁹⁷Au via (n, γ) reaction. A compilation of the recommended $k_0 Au$, Q_0 and \overline{E}_r values 129 can be found in [14].

130 **Experimental**

To exemplify the use of the equation model (5), we measured a lyophilized sample of cerebrospinal fluid (CSF). The experiment was intended to set up the uncertainty budget and not to reach the minimum uncertainty. The results were given in terms of mass 134 concentrations, $\rho_a = w_a/v$, where v is the factor used to convert the mass of lyophilized 135 CSF to the volume of reconstituted CSF.

136 Preparation of the samples

Ten vials of lyophilized CSF, each one corresponding to 3 mL volumes of reconstituted CSF, were purchased. The content of every single vial was moved to an acid-cleaned 8 mL cut polyethylene (PE) vial and sealed. The mass to volume conversion factor, v =99.2(12) mL g⁻¹, was obtained as the ratio of 3 mL to the average of the (ten) mass differences between the filled and empty (washed and dried out) vials. Here and hereafter, unless otherwise specified, the brackets refer to the standard uncertainty and apply to the last digits.

One sample, about 28 mm length, of an Al-0.46%Co wire (Reactor Experiment, 99.9313% purity, 0.38 mm diameter) was used as a Co monitor. The weighed mass, $m_{\rm m} =$ 8.47(5) mg, was sealed in one PE micro-tube. A conservative 1% relative standard uncertainty was assigned to the declared Co mass fraction value, $w_{\rm m} = 4.597(46) \times$ 10^{-3} g g⁻¹.

149 Neutron irradiation

150 The neutron irradiation lasted $t_i = 6.000(5)$ h and was performed in the 250 kW TRIGA 151 Mark II reactor at the Laboratory of Applied Nuclear Energy (LENA) of the University of 152 Pavia. The quoted uncertainty corresponds to a uniform probability distribution assigned 153 to the t_i value and having a 30 s half-width.

The vial containing the lyophilized CSF sample and the micro-tube containing the Al-Co wire were put in one PE container used for irradiation and located in the central channel (CC) of the reactor; the neutron flux parameters at CC, f = 15.6(3) and $\alpha = -0.036(6)$, were recently measured [15]. The position of the lyophilized CSF sample and of the Al-Co wire during the irradiation is shown in Figure 1.



159

160 161

Fig 1 Position of the lyophilized CSF sample and of the Al-Co wire during the irradiation. Dimensions in mm

162 *Gamma spectrometry*

163 After irradiation, the lyophilized CSF sample was moved from its vial to a new 10 mL PE 164 vial and weighed; the mass, m_a , was found to be 240.00(5) mg, corresponding to 23.81(28) 165 mL volume of reconstituted CSF in the case of negligible effect due to humidity. The 166 relative loss of sample was about 20%, probably due to the lyophilized CSF residuals in 167 the vials. The Al-Co wire was removed from its micro-tube, placed in a new 10 mL vial 168 and dissolved using a few drops of nitric and hydrochloric acid (1:1) solution. After 169 complete digestion, water was added to obtain the same volume as the lyophilized CSF 170 sample.

171 The γ -spectra were recorded with a high purity germanium (HPGe) detector, ORTEC 172 GEM50P4-83 (relative efficiency 50%, resolution 1.90 keV at 1332 keV) inside a low-173 background graded shield. The detector was connected to a digital signal processor ORTEC 174 DSPEC 502 and the data were collected and processed using the ORTEC Gamma Vision 175 software (version 6.08). The acquisition was performed in extended live-time correction 176 mode using the Gedcke-Hale method with pulse pile-up rejection in automatic set 177 threshold; the excess counting loss constant of the detection system, $\mu = 0.0445(5)$, was 178 recently measured [13].

- 179 The position of the lyophilized CSF and dissolved Al-Co wire samples with respect to the
- 180 detector end-cap is shown in Figure 2a.



Fig 2 Position of the lyophilized CSF and dissolved Al-Co wire samples (a), and of the disk source (b) with respect to the detector end-cap. Dimensions in mm

183 The collection of the γ -spectrum emitted by the CSF sample started at $t_{d a} =$ 184 667.890(10) h, lasted $t_{c a} = 359.0633(1)$ h and ended with a live time $t_{l a} =$ 185 351.1856(1) h. The dissolved Al-Co monitor was successively measured. The collection 186 of the γ -spectrum started at $t_{d m} = 1034.10(1)$ h, lasted $t_{c m} = 797.0(3)$ s and ended with 187 a live time $t_{l m} = 740.0(3)$ s. The quoted uncertainties correspond to uniform probability 188 distributions assigned to the t_d , t_c and t_l values and having 60 s, 0.5 s and 0.5 s half-widths, 189 respectively.

190 **Detection system characterization**

191 Full-energy γ -peak detection efficiency

192 The $\varepsilon_p^{\text{geo}}$ values in (5) depend on the actual position and geometry of the measured samples.

193 The dependence is strengthened when extensive samples are measured close to the detector194 end-cap, as in this case.

In principle, the reconstruction of the $\varepsilon_p^{\text{geo}}$ versus the γ -energy, E_{γ} , might be performed by measuring the γ -emissions of an extensive standard source having the same shape as the analyte and monitor sample and located at the same position with respect to the detector end-cap. In addition, the material of the source should have the same major elemental composition as the monitor and analyte sample in order to mimic the γ self-absorption.

Actually, a more flexible procedure based on a computational technique coupled to a quasipoint standard source measured at large source-detector distance is commonly adopted [16]; geometries and major elemental composition of sample and layers between the Ge crystal and sample are required.

As an approximated alternative, we recorded two γ -spectra with a disk standard source positioned at the vertical ends of the measured extended samples, as shown in Figure 2b. The efficiency of the (virtual) extensive source, $\varepsilon_p^{\text{ext}}$, was estimated by the average of the disk efficiencies in positions 1 and 2, $\varepsilon_{p \text{ pos1}}^{\text{disk}}$ and $\varepsilon_{p \text{ pos2}}^{\text{disk}}$, respectively.

The coincidence free γ -emissions selected to reconstruct the efficiency curves were ²⁴¹Am 59.54 keV, ¹⁰⁹Cd 88.03 keV, ⁵⁷Co 122.06 keV, ¹³⁹Ce 165.86 keV, ¹¹³Sn 391.70 keV, ¹³⁷Cs 661.66 keV, ⁵⁴Mn 834.85 keV and ⁶⁵Zn 1115.54 keV.

211 The $\varepsilon_{p \text{ pos1}}^{\text{disk}}$, $\varepsilon_{p \text{ pos2}}^{\text{disk}}$ and $\varepsilon_{p}^{\text{ext}}$ versus E_{γ} data were fitted by the equation model

212
$$\ln \varepsilon_{\rm p} = a_1 E_{\gamma} + a_0 + a_{-1} E_{\gamma}^{-1} + a_{-2} E_{\gamma}^{-2} + a_{-3} E_{\gamma}^{-3}, \tag{6}$$

where a_1 , a_0 , a_{-1} , a_{-2} and a_{-3} are the fitting parameters. Best values, including uncertainties and correlation matrix, were calculated using the algorithm implemented in the OriginPro 2017.

216 The values obtained with the $\varepsilon_p^{\text{ext}}$ data were $a_1 = -4.72(43) \times 10^{-1} \text{ MeV}^{-1}$, $a_0 =$

217
$$-3.229(57)$$
, $a_{-1} = 4.03(20) \times 10^{-1}$ MeV, $a_{-2} = -3.20(22) \times 10^{-2}$ MeV², $a_{-3} = -3.20(22) \times 10^{-2}$

218 $-5.73(75) \times 10^{-4}$ MeV³; the corresponding correlation matrix is shown in Table 1.

219	Table	1	Correlation	matrix	of	the	fitting
220	narame	ters	obtained with	the e ^{ext}	data	1	

	a_1	a_0	a_{-1}	a_{-2}	a_{-3}
a_1	1.000	-0.973	0.884	-0.804	0.748
a_0	-0.973	1.000	-0.957	0.896	-0.848
<i>a</i> ₋₁	0.884	-0.957	1.000	-0.984	0.957
a_{-2}	-0.804	0.896	-0.984	1.000	-0.993
<i>a</i> ₋₃	0.748	-0.848	0.957	-0.993	1.000

221 The $\varepsilon_{p \text{ pos1}}^{\text{disk}}$, $\varepsilon_{p \text{ pos2}}^{\text{disk}}$ and $\varepsilon_{p}^{\text{ext}}$ versus E_{γ} curves and the $\varepsilon_{p}^{\text{ext}}$ residuals are plotted in Figure 3a

and Figure 3b, respectively. The error bars indicate a 95% confidence interval due to fitting,

taking into account the correlations.





Possible differences in counting positions of the measured samples with respect to the(virtual) extensive source were considered according to:

228
$$\frac{\varepsilon_{\rm p\,m}^{\rm geo}}{\varepsilon_{\rm p\,a}^{\rm geo}} = \frac{\varepsilon_{\rm p\,m}^{\rm ext}}{\varepsilon_{\rm p\,a}^{\rm ext}} \frac{(1 - \delta\varepsilon_{\rm r\,m}\,\Delta d_{\rm m})}{(1 - \delta\varepsilon_{\rm r\,a}\,\Delta d_{\rm a})},\tag{7}$$

where $\Delta d_{\rm m}$ and $\Delta d_{\rm a}$ are the vertical position differences between the dissolved Al-Co wire and the (virtual) extensive source and between the lyophilized CSF sample and the (virtual) extensive source, respectively, and $\delta \varepsilon_{\rm r,m}$ and $\delta \varepsilon_{\rm r,a}$ are the relative variations of the detection efficiency per unit of vertical position for the monitor and the analyte, respectively.

233 The $\delta \varepsilon_{\rm r}$ values were obtained from the ratio of $(\varepsilon_{\rm p\,pos2}^{\rm disk} - \varepsilon_{\rm p\,pos1}^{\rm disk})/\varepsilon_{\rm p}^{\rm ext}$ to the difference 234 between the vertical positions 1 and 2, i.e. 11 mm, and plotted versus E_{γ} in Figure 4.



235

Fig 4 $\delta \varepsilon_r$ versus E_{γ} curve. The vertical dashed line at about 240 keV splits the curve in two different regions

The data were fitted by $\delta \varepsilon_{\rm r} = d_0 + d_1 E_{\gamma}$ and $\delta \varepsilon_{\rm r} = e_0 + e_1 E_{\gamma} + e_2 E_{\gamma}^2 + e_3 E_{\gamma}^3 + e_4 E_{\gamma}^4$, for γ -energies above and below the 240 keV threshold, respectively. The resulting values were $e_4 = -7.10 \times 10^{-11} \text{ keV}^{-4}$, $e_3 = 5.19 \times 10^{-8} \text{ keV}^{-3}$, $e_2 = -1.43 \times 10^{-5} \text{ keV}^{-2}$, $e_1 = 1.78 \times 10^{-3} \text{ keV}^{-1}$, $e_0 = -4.46 \times 10^{-2}$ and $d_1 = 5.56 \times 10^{-6} \text{ keV}^{-1}$, $d_0 = 4.17 \times 10^{-2}$.

243 Peak-to-total ratio

True-coincidence occurs when two or more cascading γ -photons are emitted with negligible time delay by a radionuclide. The effect becomes significant when samples are measured close to the detector end-cap.

247 The number of counts collected in the full-energy γ -peak, $n_{\rm p}$, is adjusted using the 248 correction factor

249
$$\text{COI} = (1 - L_{\gamma})(1 + S_{\gamma}),$$
 (8)

where L_{γ} and S_{γ} are the overall probabilities for coincidence loss and summing, respectively [4].

The formulae adopted to calculate L_{γ} and S_{γ} values depend on the cascade schemes and include several nuclear parameters, the most important ones being the absolute emission probability of the γ -photons, P_{γ} , the branching ratio, a_{γ} , and the total internal conversion coefficient, α_{t} . In addition, $\varepsilon_{p}^{\text{geo}}$ and the peak-to-total ratio, P/T, of the detection system are required.

E.g., the probability for coincidence loss of γ_A and γ_B in the case of $\gamma_A \rightarrow \gamma_B$ decay scheme is

259
$$L_{\gamma_{\rm A}} = a_{\gamma_{\rm B}} c_{\gamma_{\rm B}} \frac{\varepsilon_{\rm p\,\gamma_{\rm B}}^{\rm geo}}{(P/T)_{\gamma_{\rm B}}} \text{ and } L_{\gamma_{\rm B}} = \frac{P_{\gamma_{\rm A}}}{P_{\gamma_{\rm B}}} a_{\gamma_{\rm B}} c_{\gamma_{\rm B}} \frac{\varepsilon_{\rm p\,\gamma_{\rm A}}^{\rm geo}}{(P/T)_{\gamma_{\rm A}}}, \tag{9}$$

260 respectively, where $c_{\gamma} = 1/(1 + \alpha_{t\gamma})$, whereas the probability for coincidence summing 261 of γ_A with the $\gamma_B \rightarrow \gamma_C$ decay scheme is

262
$$S_{\gamma_{\rm A}} = \frac{P_{\gamma_{\rm B}}}{P_{\gamma_{\rm A}}} a_{\gamma_{\rm C}} c_{\gamma_{\rm C}} \frac{\varepsilon_{\rm p \gamma_{\rm B}}^{\rm geo} \varepsilon_{\rm p \gamma_{\rm C}}^{\rm geo}}{\varepsilon_{\rm p \gamma_{\rm A}}^{\rm geo}}.$$
 (10)

A compilation of the nuclear parameters values and the cascade schemes concerning the radionuclides generally used in NAA are reported in [4].

Similar to $\varepsilon_p^{\text{geo}}$, the *P*/*T* ratio versus E_{γ} data can be ideally obtained from γ -spectra of coincidence free radionuclides embedded in extensive sources having the same material

and shape as the analyte and monitor sample and located at the same position with respect to the detector end-cap. In practice, since the P/T ratio is above all depending on the position and to a smaller extent on the composition and geometry of the samples, use of quasi-point γ -sources might be accepted.

In this study, we used five γ -emissions, i.e. ²⁴¹Am 59.54 keV, ¹⁷⁰Tm 84.25 keV, ²⁰³Hg 272 279.19 keV, ¹³⁷Cs 661.66 keV and ⁶⁵Zn 1115.54 keV, to reconstruct the *P/T* ratio curve.

The data were fitted by $\log P/T = b_0 + b_1 \log E_{\gamma}$ and $\log P/T = c_0 + c_1 \log E_{\gamma} + c_2 (\log E_{\gamma})^2$, for γ -energies above and below the 170 keV threshold, respectively. To avoid a discontinuity, the first derivative with respect to $\log E_{\gamma}$ of the latter equation model at 170 keV was imposed to be the b_1 value. The resulting values were $b_1 = -0.571$, $b_0 =$ 1.079, $c_2 = -1.625$, $c_1 = 6.678$ and $c_0 = -7.006$.

278 The *P*/*T* ratio versus E_{γ} curve is plotted in Figure 5.



279

Fig 5 P/T ratio versus E_{γ} curve. The vertical dashed line at about 170 keV splits the curve in two different regions

282 **Results and discussion**

283 The analysis of the γ -spectrum of the lyophilized CSF sample pointed out ²³³Pa, ⁵¹Cr, ¹³¹Ba, 284 ¹²⁴Sb, ⁴⁶Sc, ⁸⁶Rb, ⁵⁹Fe, ⁶⁵Zn and ⁶⁰Co γ -emissions produced by neutron capture reactions from ²³²Th, ⁵⁰Cr, ¹³⁰Ba, ¹²³Sb, ⁴⁵Sc, ⁸⁵Rb, ⁵⁸Fe, ⁶⁴Zn and ⁵⁹Co. The mass concentrations of the corresponding elements were quantified using the ⁶⁰Co γ -emission of the monitor.

The number of counts collected in the γ -peaks were evaluated with the algorithm implemented in the ROI32 analysis engine of the Gamma Vision software. The γ -peak energies and n_p values of the detected radionuclides in the CSF sample and monitor are reported in Table 2; the uncertainty (conservatively) assigned to E_{γ} corresponds to a uniform distribution with 0.2 keV half-width whereas the n_p uncertainty is due to counting statistics, including background.

294

Table 2 γ -peak energies and corresponding number of counts of the detected radionuclides

Radionuclide	E_{γ} / keV	<i>n</i> _p / 1
233 Pa ^(CSF)	311.90(12)	$1.017(24) \times 10^5$
$^{51}Cr^{(CSF)}$	320.10(12)	$5.26(15) \times 10^4$
$^{131}Ba^{(CSF)}$	496.30(12)	$5.08(12) \times 10^4$
124 Sb ^(CSF)	1691.00(12)	$2.47(21) \times 10^2$
46 Sc ^(CSF)	889.30(12)	$1.3070(80) \times 10^5$
⁸⁶ Rb ^(CSF)	1077.00(12)	$4.56(44) \times 10^3$
⁵⁹ Fe ^(CSF)	1099.30(12)	$9.46(59) \times 10^3$
⁶⁵ Zn ^(CSF)	1115.50(12)	$1.2260(47) \times 10^5$
⁶⁰ Co ^(CSF)	1173.20(12)	$4.68(44) \times 10^3$
⁶⁰ Co ^(monitor)	1173.20(12)	$1.3749(44) \times 10^5$

The full-energy γ -peak detection efficiencies ratio, $\varepsilon_{p m}^{geo}/\varepsilon_{p a}^{geo}$, was computed according to 295 (7) using a_1 , a_0 , a_{-1} , a_{-2} , a_{-3} and d_1 , d_0 , e_0 , e_1 , e_2 , e_3 , e_4 to obtain $\varepsilon_{p\,m}^{ext}/\varepsilon_{p\,a}^{ext}$ and $\delta\varepsilon_r$, 296 respectively, as a function of E_{γ} . The uncertainty of the $\varepsilon_{p m}^{\text{ext}}/\varepsilon_{p a}^{\text{ext}}$ was evaluated taking into 297 account uncertainties and correlations of the fitting parameters whereas a uniform 298 299 probability distribution with a (conservative) 20% relative half-width was directly assigned 300 to the $\delta \varepsilon_r$ value. In addition, it was assumed that the vertical position of the samples was within ±0.5 mm with respect to the (virtual) extensive γ -source; accordingly, $\Delta d_{\rm m} = \Delta d_{\rm a} =$ 301 302 0.00(29) mm, the quoted uncertainty corresponding to a uniform probability distribution 303 having 0.5 mm half-width.

²⁹³

The true-coincidence correction factors ratio, $\text{COI}_{\text{m}}/\text{COI}_{\text{a}}$, was obtained via (8) using b_0 , b_1 , c_0 , c_1 and c_2 to determine P/T as a function of E_{γ} . A uniform probability distribution with a (conservative) 20% relative half-width was directly assigned to the P/T value. The effect due to possible differences in counting positions was neglected; specifically, $\varepsilon_p^{\text{geo}}$ was used instead of $\varepsilon_p^{\text{ext}}$ in (9) and (10). Cascade schemes, notations and P_{γ} , a_{γ} , α_t values proposed in [4] were adopted with uncertainties corresponding to uniform probability distributions having 0.0002, 0.02 and 0.02 half-widths, respectively.

311 A list of neutron capture reactions and $t_{1/2}$, $k_{0 Au}$, Q_0 , \overline{E}_r values recommended in the k_0

database [14] and used in this study are reported in Table 3 for reader's convenience.

Reaction	<i>t</i> _{1/2} / h	k _{0 Au} / 1	Q ₀ / 1	$\overline{E}_{ m r}$ / eV
232 Th(n, γ) 233 Pa	647.280(48)	$2.520(13) \times 10^{-2}$	11.50(41)	54.40(49)
${}^{50}\mathrm{Cr}(\mathbf{n},\gamma){}^{51}\mathrm{Cr}$	664.800(58)	$2.620(13) \times 10^{-3}$	0.53(11)	$753(83) \times 10^{1}$
130 Ba(n, γ) 131 Ba	276.0(14)	$6.480(13) \times 10^{-5}$	24.8(50)	69.9(35)
123 Sb(n, γ) 124 Sb	1444.80(72)	$1.410(16) \times 10^{-2}$	28.8(11)	28.2(18)
45 Sc(n, γ) 46 Sc	2011.92(48)	1.2200(49)	0.430(86)	$513(87) \times 10^{1}$
85 Rb(n, γ) 86 Rb	447.12(48)	$7.650(77) \times 10^{-4}$	14.80(37)	839(50)
58 Fe(n, γ) 59 Fe	1068.00(14)	$7.770(39) \times 10^{-5}$	0.975(10)	$64(15) \times 10^{1}$
64 Zn(n, γ) 65 Zn	5863.2(24)	$5.720(23) \times 10^{-3}$	1.91(10)	$256(26) \times 10^{1}$
$^{59}Co(n, \gamma)^{60}Co$	46207.2(72)	1.3200(53)	1.993(60)	136.0(69)

313 **Table 3** Neutron capture reactions and adopted $t_{1/2}$, $k_{0 \text{ Au}}$, Q_0 , \overline{E}_r values.

Values and uncertainties assigned to t_i , $t_{d a}$, $t_{c a}$, $t_{l a}$, $t_{c m}$, $t_{l m}$, μ , f, α , m_a , m_m , w_m and ν are given in the section 3. The thermal and epithermal neutron self-shielding of the lyophilized CSF sample and of the dissolved (and diluted) Co monitor were considered insignificant. Accordingly, $G_{th m} = G_{th a} = G_{e m} = G_{e a} = 1.000$ with negligible uncertainty.

319 Uncertainty budget

320 The spreadsheet technique was applied to set up the uncertainty budget of the analyte mass

321 concentration, ρ_a , via the measurement model (5).

322 The input quantities for ρ_a were t_i , μ , $t_{1/2 a}$, $t_{1/2 m}$, $t_{d a}$, $t_{c a}$, $t_{l a}$, $t_{d m}$, $t_{c m}$, $t_{l m}$, $n_{p a}$, $n_{p m}$,

- 323 $k_{0 \text{Au}}(a), k_{0 \text{Au}}(m), G_{\text{th a}}, G_{\text{e a}}, G_{\text{th m}}, G_{\text{e m}}, f, \alpha, Q_{0 a}, \overline{E}_{r a}, Q_{0 m}, \overline{E}_{r m}, \varepsilon_{p m}^{\text{geo}}/\varepsilon_{p a}^{\text{geo}}, \text{COI}_{m}/\text{COI}_{a},$
- 324 $m_{\rm m}, m_{\rm a}, w_{\rm m}$ and v. The intermediate quantities $\lambda_{\rm a}, \lambda_{\rm m}, \delta_{\rm a}, \delta_{\rm m}, \xi_{\rm a}, \xi_{\rm m}, Q_{0 \rm a}(\alpha)$ and $Q_{0 \rm m}(\alpha)$
- 325 were calculated for information.

For simplicity, the $\varepsilon_{p\,n}^{geo}/\varepsilon_{p\,a}^{geo}$ and COI_m/COI_a values and uncertainties were computed 326 327 separately via the measurement models (7) and (8), respectively. The input quantities for $\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}$ were $a_1, a_0, a_{-1}, a_{-2}, a_{-3}, E_{v\,m}, E_{v\,a}, \Delta d_a, \Delta d_m, \delta \varepsilon_{r\,a}$ and $\delta \varepsilon_{r\,m}$ while the input 328 quantities for COI_m/COI_a were $a_1, a_0, a_{-1}, a_{-2}, a_{-3}$ and additional parameters depending 329 on the cascade scheme, e.g. E_{γ} , a_{γ} , c_{γ} , P/T and P_{γ} either for the monitor and for the analyte. 330 The quantities e_4 , e_3 , e_2 , e_1 , e_0 , d_1 and d_0 used to compute $\delta \varepsilon_r$ and the quantities b_1 , b_0 , 331 c_2 , c_1 and c_0 used to compute P/T were given for information. The (small) correlation 332 333 effect due to the shared parameters a_1, a_0, a_{-1}, a_{-2} and a_{-3} was neglected.

334 The formulae were implemented in a MS excel file [17] consisting of nine worksheets, one 335 for each quantified analyte. A single worksheet included four sections. Irradiation time, day and time of the irradiation end, day and time of the γ -counting start, outputs of the 336 Gamma Vision software, target nuclide and produced radionuclide were given in the first 337 section, called "Irradiation and y-spectrometry". Values, standard uncertainties and 338 339 correlation coefficients of the input quantities were added in the main section, called "Uncertainty budget of ρ_a ", with the exception of the $\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}$ and COI_m/COI_a ratios, 340 whose data were added and calculated in two sub-sections, called "Uncertainty budget of 341 $\varepsilon_{p m}^{geo}/\varepsilon_{p a}^{geo}$ and "Uncertainty budget of COI_m/COI_a , respectively. 342

Values and combined uncertainties of ρ_a , $\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}$ and COI_m/COI_a were calculated together with sensitivity coefficients of the input quantities and their relative contribution; the matrix formalism was used to propagate the uncertainties via the correlation matrices R_{ρ_a} , $R_{\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}}$ and R_{COI_m/COI_a} .

347The analysis quantified $2.32(11) \times 10^{-10}$ g mL⁻¹ of Th, $2.096(99) \times 10^{-9}$ g mL⁻¹ of Cr,348 $6.89(96) \times 10^{-8}$ g mL⁻¹ of Ba, $4.01(39) \times 10^{-11}$ g mL⁻¹ of Sb, $5.06(15) \times 10^{-11}$ g mL⁻¹ of Sc,

 $\begin{array}{ll} 349 & 8.00(85)\times10^{-10}~{\rm g}~{\rm mL}^{-1}~{\rm of}~{\rm Rb},~3.87(27)\times10^{-8}~{\rm g}~{\rm mL}^{-1}~{\rm of}~{\rm Fe},~2.220(77)\times10^{-8}~{\rm g}~{\rm mL}^{-1}~{\rm of}~{\rm Zn}\\ 350 & {\rm and}~3.24(31)\times10^{-11}~{\rm g}~{\rm mL}^{-1}~{\rm of}~{\rm Co}. \end{array}$

The uncertainty budgets are given in the developed MS excel file available in the Supplementary Information; cells dealing with informative or intermediate data were

- 353 grayed. In $\mathbf{R}_{\varepsilon_{p\,m}^{\text{geo}}/\varepsilon_{p\,a}^{\text{geo}}}$ and $\mathbf{R}_{\text{COI}_{m}/\text{COI}_{a}}$, we set the correlation coefficients of $a_{1}, a_{0}, a_{-1}, a_{-2}$
- and a_{-3} according to the data shown in Table 1; in addition, as a first attempt, in $R_{\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}}$,
- 355 we set to the unity value the correlation between $\delta \varepsilon_{ra}$ and $\delta \varepsilon_{rm}$, and in R_{COI_m/COI_a} , we set
- to the unity value the correlation between P/T_{γ} values, if existing.

A survey of the main contributors to the combined uncertainties is given in Table 4 whilethe (complete) Cr budget is shown in the Supplementary Information.

Table 4 Main contributors to the combined uncertainty of the quantified elements. Input quantities, X_i , are explained in the text. The index I is the relative contribution of X_i

Т	ĥ	C	r	I	За	5	Sb	5	Sc	R	lb	F	⁷ e	Z	n	(Co
X _i	I / %	X _i	I / %	X _i	I / %												
$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	26.7	$n_{\mathrm{p}\mathrm{a}}$	35.3	$Q_{0 a}$	89.3	n _{pa}	77.6	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	49.3	n _{pa}	83.4	n _{pa}	78.0	$\frac{\text{COI}_{\text{m}}}{\text{COI}_{\text{a}}}$	33.1	n _{pa}	92.8
$n_{\mathrm{p}\mathrm{a}}$	25.1	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	27.4	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	3.2	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	8.0	v	16.0	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	3.5	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	7.9	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	32.6	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	4.1
$\frac{\text{COI}_{\text{m}}}{\text{COI}_{\text{a}}}$	16.1	$\frac{\text{COI}_{m}}{\text{COI}_{a}}$	17.6	n _{pa}	2.9	Q_{0a}	6.6	<i>w</i> _m	10.9	$\frac{\text{COI}_{\text{m}}}{\text{COI}_{\text{a}}}$	3.5	$\frac{\text{COI}_{\text{m}}}{\text{COI}_{\text{a}}}$	6.9	v	12.3		
Q_{0a}	12.0	v	6.5					Q_{0a}	5.8					<i>w</i> _m	8.4		
v	6.4	<i>w</i> _m	4.5					n _{pa}	4.1					Q_{0a}	4.1		

361 In summary, the uncertainty of the results was largely due to $\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}$, $n_{p\,a}$ and 362 COI_m/COI_a . In a few cases, v, w_m and m_m had an influence while the 20% uncertainty of 363 the $Q_{0\,a}$ recommended in the k_0 database [14] had the overriding effect for the 364 determination of Ba.

365 It is worth to observe that the contribution to $\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}$ due to possible differences in 366 counting positions of samples could be canceled if the monitor element was embedded in the analyte sample [18, 19]; this was confirmed by setting the correlation coefficient between Δd_{a} and Δd_{m} in $\boldsymbol{R}_{\varepsilon_{p}^{\text{geo}}/\varepsilon_{p}^{\text{geo}}}$ to the unity value.

Besides, the result of Co deserves attention. In this case, i.e. when the analyte corresponds to the monitor element and the same γ -emission is used, the k_0 -NAA turns into the relative-NAA. Accordingly, we set to the unity value the correlation coefficients between $t_{1/2}$, $t_{1/2}$. $k_{0 Au}$, Q_0 and \overline{E}_r in \mathbf{R}_{ρ_a} and between E_{γ} , a_{γ} , c_{γ} , P/T_{γ} in $\mathbf{R}_{\text{COI}_m/\text{COI}_a}$. As a result, the contributions due to the "intrinsic" uncertainty characteristic of the k_0 -NAA method [8] and due to the $\text{COI}_m/\text{COI}_a$ were reset; moreover, the correlation coefficients of a_1 , a_0 , a_{-1} , a_{-2} and a_{-3} in $\mathbf{R}_{\varepsilon_{p m}^{\text{geo}}/\varepsilon_{p a}^{\text{geo}}}$ made their contribution to $\varepsilon_{p m}^{\text{ext}}/\varepsilon_{p a}^{\text{ext}}$ zero as well.

376 **Conclusions**

The spreadsheet approach proved to be suitable to set up the uncertainty budget for the k_0 standardisation method in NAA when the majority of the recognized sources of error are considered and the measurement model is written to limit the correlations between input quantities. The use of the matrix formalism was straightforward to propagate the uncertainties by taking into account the covariances.

A MS excel file was developed and tested for the determination of Th, Cr, Ba, Sb, Sc, Rb, Fe, Zn and Co in a lyophilized CSF sample. The uncertainty budget of each element was compiled once the estimates, the uncertainties and the correlation coefficients associated with the input quantities were specified. The value and combined uncertainty of the result were calculated and the most overriding contributors were pointed out.

387 It was shown that when the monitor element corresponded to the analyte element and the 388 same γ -emission was used, the worksheet set up the uncertainty budget for the relative-389 NAA method; this makes the proposed approach applicable either in the relative- and k_0 -390 NAA.

391 The MS excel file is open and free available to users. The implemented measurement model392 allows a broad application, e.g. in case of different sample material, monitor element,

neutron irradiation and γ -spectrometry conditions. The extension to other elements is possible by a simple duplication of the existing worksheets; only the modification of the formulae adopted to compute the COI_m/COI_a ratio might be required for other decay schemes.

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- 440 Supplementary information
- 441 Developed worksheet file
- 442 See the MS excel file "uncertainty_k0_spreadsheet.xlsx"
- 443 Uncertainty budget of Cr

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The (complete) uncertainty budget of the Cr determination is here reported. According to Table 1, the most overriding contributors to the combined uncertainty were n_{pa} (35.3%), $\varepsilon_{pm}^{geo}/\varepsilon_{pa}^{geo}$ (27.4%) and $\text{COI}_{m}/\text{COI}_{a}$ (17.6%). The remaining 19.7% was due to v, w_{m} , $Q_{0a}, m_{m}, k_{0Au}(a), k_{0Au}(m), Q_{0m}, n_{pm}, \alpha$ and f, in decreasing order of importance. As regards to $\varepsilon_{pm}^{geo}/\varepsilon_{pa}^{geo}$ (see Table 2), the main contributors were a_1, a_{-1}, a_{-2} (44.0%), Δd_{a} (25.6%) and Δd_{m} (31.5%), while the uncertainty of $\text{COI}_{m}/\text{COI}_{a}$ (see Table 3) was due to $P/T_{\gamma 2 m}$ (96.1%).

451 The a_0 value is not affecting $\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}$. In fact, a_0 in equation (6) models a constant 452 multiplying factor that is deleted from the detection efficiency ratio. In addition, since we 453 considered $\Delta d_a = \Delta d_m = 0$ mm, the contribution of $\delta \varepsilon_{r\,a}$ and $\delta \varepsilon_{r\,m}$ was reset.

Table 1 Uncertainty budget of the mass concentration of Cr in the lyophilized CSF sample. Quantities are explained in the text. The column Index gives the relative contribution of the input quantity, X_i , to the output quantity, Y. Values of the sensitivity coefficient, c_i , and Index are omitted for those quantities that are not actual inputs of the measurement model.

Quantity	Unit	Value	Std. Uncertainty	Sens. Coeff.	Index
X _i	$[X_i]$	x_{i}	$u(x_i)$	Ci	I / %
t _i	s	$2.1600 imes 10^4$	$1.7 imes 10^1$	$3.0 imes 10^{-16}$	0.0
μ	1	$4.45 imes 10^{-2}$	$5 imes 10^{-4}$	$\textbf{-1.0}\times10^{\textbf{-10}}$	0.0
t _{1/2 a}	s	2.39328×10^{6}	$2.1 imes 10^2$	$1.1 imes 10^{-16}$	0.0
λ_{a}	s ⁻¹	$2.89622 imes 10^{-7}$	$2.5 imes 10^{-11}$		
<i>t</i> _{1/2 m}	s	1.66346×10^{8}	$2.6 imes 10^4$	$-1.2 imes 10^{-17}$	0.0
$\lambda_{ m m}$	s ⁻¹	4.16690×10^{-9}	$6.5 imes 10^{-13}$		
t _{d a}	S	2.404405×10^{6}	$3.5 imes 10^1$	6.1 × 10 ⁻¹⁶	0.0

1.29262800×10^{6} $2.9 imes 10^{-1}$ $3.6\times10^{\text{--}16}$ S t_{ca} $\textbf{-}1.7\times10^{\textbf{-}15}$ 1.26426800×10^{6} $2.9 imes 10^{-1}$ t_{la} s 3.722775×10^{6} $3.5 imes 10^1$ $-8.7 imes 10^{-18}$ s t_{d m}

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ι _{cm}	5	7.9700×10^{-1}	2.9×10^{-1}	-1.1×10^{10}	0.0
t _{lm}	s	$7.400 imes 10^2$	$2.9 imes 10^{-1}$	$2.9 imes 10^{-12}$	0.0
δ_{a}	1	1.022	0.000		
$\delta_{ m m}$	1	1.077	0.001		
ξa	1	1.00098	1×10^{-5}		
$\xi_{\rm m}$	1	1.00319	4×10^{-5}		
n _{pa}	1	$5.26 imes 10^4$	$1.5 imes 10^3$	$4.0 imes 10^{-14}$	35.3
n _{p m}	1	$1.3749 imes 10^5$	$4.4 imes 10^2$	$\textbf{-1.5}\times10^{\textbf{-14}}$	0.5
$k_{0 Au}(a)$	1	$2.620\times10^{\text{-3}}$	$1.3 imes 10^{-5}$	$\textbf{-8.0}\times10^{\textbf{-7}}$	1.1
$k_{0 Au}(m)$	1	1.3200	$5.3 imes 10^{-3}$	$1.6 imes 10^{-9}$	0.7
$G_{\mathrm{th}\mathrm{a}}$	1	1.000	0.000	$-2.0 imes 10^{-9}$	0.0
G _{e a}	1	1.000	0.000	$\textbf{-7.7}\times10^{\textbf{-}11}$	0.0
G _{th m}	1	1.000	0.000	$1.8 imes 10^{-9}$	0.0
G _{e m}	1	1.000	0.000	2.7×10^{10}	0.0
f	1	$1.560 imes 10^1$	3.3×10^{-1}	$\textbf{-}1.2\times10^{\textbf{-}11}$	0.2
α	1	-3.60×10^{-2}	6.4×10^{-3}	$\textbf{-9.0}\times10^{\textbf{-10}}$	0.3
<i>Q</i> _{0 a}	1	$5.3 imes 10^{-1}$	1.1×10^{-1}	$-1.8 imes 10^{-10}$	3.6
Ē _{ra}	eV	$7.53 imes 10^3$	$8.3 imes 10^2$	$\textbf{-8.7}\times10^{\textbf{-17}}$	0.0
$Q_{0a}(\alpha)$	1	$5.9 imes 10^{-1}$	$1.5 imes 10^{-1}$		
<i>Q</i> _{0 m}	1	1.993	$6.0 imes10^{-2}$	$1.4 imes 10^{-10}$	0.7
$\bar{E}_{\rm r \ m}$	eV	1.360×10^2	6.9	$5.8\times10^{\text{-}14}$	0.0
$Q_{0 \mathrm{m}}(\alpha)$	1	2.319	$9.5 imes 10^{-2}$		
$arepsilon_{ m pm}^{ m geo}/arepsilon_{ m pa}^{ m geo}$	1	$3.507 imes 10^{-1}$	8.7×10^{-3}	$6.0 imes10^{-9}$	27.4
COI _m /COI _a	1	8.57×10^{-1}	1.7×10^{-2}	$2.4 imes 10^{-9}$	17.6
m _m	g	8.47×10^{-3}	5×10^{-5}	$2.5 imes 10^{-7}$	1.6
m _a	g	$2.4000 imes 10^{-1}$	5×10^{-5}	-8.7×10^{-9}	0.0
<i>w</i> _m	g g ⁻¹	$4.597 imes 10^{-3}$	$4.6 imes 10^{-5}$	$4.6\times10^{\text{-7}}$	4.5
v	mg L ⁻¹	99.2	1.2	-2.1×10^{-11}	6.6
Y	[<i>Y</i>]	У	$u_{\rm c}(y)$		
$ ho_{a}$	g mL ⁻¹	2.096×10^{-9}	$9.9 imes 10^{-11}$		

0.0

0.0

0.0

Table 2. Uncertainty budget of the $\varepsilon_{p m}^{geo} / \varepsilon_{p a}^{geo}$ ratio given in Table 1.

Quantity	Unit	Value	Std. Uncertainty	Sens. Coeff.	Index
X _i	$[X_i]$	x_{i}	$u(x_i)$	Ci	I / %
<i>a</i> ₁	MeV ⁻¹	-4.72×10^{-1}	4.3×10^{-2}	3.0×10^{-1}	74.1

-					
a_0	1	-3.229	$5.7 imes 10^{-2}$	0.0	0.0
<i>a</i> ₋₁	MeV	$4.03 imes 10^{-1}$	$2.0 imes 10^{-2}$	-8.0×10^{-1}	-43.1
a_2	MeV ²	3.20×10^{-2}	2.2×10^{-3}	-3.2	13.0
a_3	MeV ³	5.73×10^{-4}	$7.5 imes 10^{-5}$	-1.0×10^{1}	-1.1
E _{γm}	MeV	1.17320	1.2×10^{-4}	-2.5×10^{-1}	0.0
Eγa	MeV	3.2010×10^{-1}	1.2×10^{-4}	9.2×10^{-1}	0.0
Δd_{a}	mm	0.00	0.29	1.5×10^{-2}	25.6
$\Delta d_{ m m}$	mm	0.00	0.29	-1.7×10^{-2}	31.5
e_4	keV ⁻⁴	-7.10×10^{-11}	$0.00 imes 10^{-11}$		
<i>e</i> ₃	keV ⁻³	$5.19 imes 10^{-8}$	$0.00 imes 10^{-8}$		
e_2	keV ⁻²	-1.43×10^{-5}	$0.00 imes 10^{-5}$		
e_1	keV ⁻¹	1.78×10^{-3}	0.00×10^{-3}		
e_0	1	-4.46×10^{-2}	0.00×10^{-2}		
d_1	keV ⁻¹	5.56×10^{-6}	$0.00 imes 10^{-6}$		
d_0	1	4.17×10^{-2}	$0.00 imes 10^{-2}$		
$\delta \varepsilon_{\rm ra}$	mm ⁻¹	4.3×10^{-2}	5×10^{-3}	0.0	0.0
$\delta \varepsilon_{ m rm}$	mm ⁻¹	4.8×10^{-2}	6×10^{-3}	0.0	0.0
Y	[Y]	у	$u_{\rm c}(y)$		
$\varepsilon_{\rm pm}^{\rm geo}/\varepsilon_{\rm pa}^{\rm geo}$	1	3.507×10^{-1}	8.7×10^{-3}		

Table 3 Uncertainty budget of the COI_m/COI_a ratio given in Table 1. (*) Notation reported in [4] and adopted for the cascade scheme.

Quantity X.	Unit $[X_i]$	Value	Std. Uncertainty $u(x)$	Sens. Coeff.	Index
a_1	MeV ⁻¹	-4.72×10^{-1}	4.3×10^{-2}	-1.9×10^{-1}	5.9
a_0	1	-3.229	$5.7 imes 10^{-2}$	-1.4×10^{-1}	-4.9
<i>a</i> ₋₁	MeV	$4.03 imes 10^{-1}$	$2.0 imes 10^{-2}$	-1.1×10^{-1}	1.0
a_2	MeV^2	3.20×10^{-2}	2.2×10^{-3}	-8.0×10^{-2}	-0.1
a_3	MeV ³	5.73×10^{-4}	$7.5 imes 10^{-5}$	-6.0×10^{-2}	0.0
<i>b</i> ₁	1	-0.571	0.000		
b_0	1	1.079	0.000		
<i>C</i> ₂	1	-1.625	0.000		
<i>c</i> ₁	1	6.678	0.000		
C ₀	1	-7.006	0.000		
$E_{\gamma 2 m}$	keV	1.3325×10^3	$1.2 imes 10^{-1}$	$9.6 imes 10^{-5}$	0.0
$a_{\gamma 2 m}$	1	1.000	0.012	-1.4×10^{-1}	0.9
$c_{\gamma 2 m}$	1	1.000	0.012	-1.4×10^{-1}	0.9
$P/T_{\gamma 2 \text{ m}}$	1	0.197	0.023	$7.3 imes 10^{-1}$	96.1

Y	[Y]	у	$u_{\rm c}(y)$	
COI _m /COI _a	1	$8.57 imes 10^{-1}$	1.7×10^{-2}	

466	This section will not appear in the printed version of your paper but it will contain a link;
467	the webpage containing the electronic supplementary information will appear when one
468	clicks on the hyperlink. Here you can list the details of your research which would be too
469	long for the main text, e.g. a larger number of spectra etc. Start with 1 for Figure and Table
470	numbers in this section.

Irradiation and γ -spectrometry

end irradiation	9/12/2017	2.46 PM
irradiation time / s	21600	

library	CSF.Lib
calib	OR50_source2016_geom_cont_12052017.Clb
sm type	CSF.Lib (ROI32 Analysis)

Nuclide	Channel	Ene	ergy B	ackground
233Pa		1246.2	311.9	1461015
Co60		4691.96	1173.2	5220
	target	pro	duct	
analite, a	²³² Th	²³³ F	Pa	
monitor, m	⁵⁹ Co	⁶⁰ C	0	

Uncertainty budget of ρ_{a}

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
t _i		S	21600
μ		1	0.0445
t _{1/2 a}		S	2330208
	λ_{a}	s ⁻¹	3.0E-07
t _{1/2 m}		S	1.7E+08
	λ_{m}	s ⁻¹	4.2E-09
t _{d a}		S	2404405
t _{ca}		S	1292628
t _{la}		S	1264268
t _{d m}		S	3722775
t _{c m}		S	797.0
t _{l m}		S	740.0
	δ_{a}	1	1.022
	δ_{m}	1	1.077
	ξa	1	1.001
	ξm	1	1.003
n _{p a}		1	101680
n _{p m}		1	137487
k _{0 Au} (a)		1	0.02520
k _{0 Au} (m)		1	1.3200
${\sf G}_{{\sf th}{\sf a}}$		1	1

G _{e a}		1	1
G _{th m}		1	1
G _{e m}		1	1
f		1	15.60
α		1	-0.0360
Q _{0 a}		1	11.50
E _{ra}		eV	54.40
	$Q_{0a}(\alpha)$	1	13.24
Q _{0 m}		1	1.993
E _{rm}		eV	136.0
	Q _{0 m} (α)	1	2.319
$\epsilon_{ m pm}^{ m geo}$ / $\epsilon_{ m pa}^{ m geo}$		1	0.3431
$\text{COI}_{\text{m}} / \text{COI}_{\text{a}}$		1	0.862
m _m		g	0.00847
m _a		g	0.24000
W _m		g g ⁻¹	0.004597
υ		mg L ⁻¹	99.2
Υ		[Y]	У
$ ho_a$		g mL ⁻¹	2.32E-10

Uncertainty budget of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
a ₁		Mev-1	-0.472
a ₀			1 -3.229
a ₋₁		Mev	0.403
a_2		Mev2	-0.0320
a ₋₃		Mev3	0.000573
$E_{\gamma m}$		MeV	1.17320
$E_{\gamma a}$		MeV	0.31190
Δd_a		mm	0
Δd_m		mm	0
	e ₄	keV-4	-7.1E-11
	e ₃	keV-3	5.2E-08
	e ₂	keV-2	-1.4E-05
	e1	keV-1	1.8E-03
	e ₀		1 -4.5E-02
	d1	keV-1	5.6E-06

d ₀		1	4.2E-02
$\delta\epsilon_{ra}$	mm ⁻¹		0.043
$\delta\epsilon_{rm}$	mm ⁻¹		0.048
Y	[Y]	У	
$\varepsilon_{p m}^{geo} / \varepsilon_{p a}^{geo}$	1		0.343

Uncertainty budget of COI_{m} / COI_{a}

Input Quantity	Quantity	Unit	Valu	Je
	X _i	[X _i]	×i	
a ₁		Mev-1		-0.472
a ₀			1	-3.229
a ₋₁		Mev		0.403
a_2		Mev2		-0.0320
a ₋₃		Mev3		0.000573
	b ₁		1	-0.571
	b ₀		1	1.079
	C ₂		1	-1.625
	C ₁		1	6.678
	C ₀		1	-7.006
E _{γ2 m}		keV		1332.50
a _{γ2 m}			1	1.000
$C_{\gamma 2 m}$			1	1.000
Ρ/Τ _{γ2 m}			1	0.197
E _{γ6 a}		keV		86.60
$P_{\gamma 6 a}$			1	2.05%
Ρ/Τ _{γ6 a}			1	0.680
a _{γ9 a}			1	0.980
C _{γ9 a}			1	0.550
$P_{\gamma 9 a}$			1	38.60%
	γ	[Y]	У	
	COI _m / COI _a		1	0.862

start counting	ce file	source file	WHM	5 F	Uncert %	Cnts/s		Net area
10/10/2017)_20171025_CSF_sa	OR50_201	1.269	2.4	.08	0.08	101680	
10/25/2017)_20170925_Co_sa	OR50_201	1.798	0.32	19 (185.919	137487	

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	ensit coeff
u(x _i)	u _r (x _i)	C _i	$u_y^2(x_i)$		x _i +u(x _i)	$y(x_i+u(x_i))$
17	0.1%	3.4E-17	3.5E-31	0.0%	2.2E+04	2.3E-10
0.0005	1.1%	-1.1E-11	3.3E-29	0.0%	4.5E-02	2.3E-10
173	0.0%	1.0E-17	3.1E-30	0.0%	2.3E+06	2.3E-10
2.2E-11	0.0%					
2.6E+04	0.0%	-1.4E-18	1.3E-27	0.0%	1.7E+08	2.3E-10
6.5E-13	0.0%					
35	0.0%	6.9E-17	5.7E-30	0.0%	2.4E+06	2.3E-10
0.3	0.0%	4.0E-17	1.3E-34	0.0%	1.3E+06	2.3E-10
0.3	0.0%	-1.9E-16	3.1E-33	0.0%	1.3E+06	2.3E-10
35	0.0%	-9.7E-19	1.1E-33	0.0%	3.7E+06	2.3E-10
0.3	0.0%	-1.2E-14	1.2E-29	0.0%	8.0E+02	2.3E-10
0.3	0.0%	3.3E-13	8.9E-27	0.0%	7.4E+02	2.3E-10
0.000	0.0%					
0.001	0.1%					
0.000	0.0%					
0.000	0.0%					
2440	2.4%	2.3E-15	3.1E-23	25.1%	1.0E+05	2.4E-10
440	0.3%	-1.7E-15	5.5E-25	0.4%	1.4E+05	2.3E-10
0.00013	0.5%	-9.2E-09	1.3E-24	1.1%	2.5E-02	2.3E-10
0.0053	0.4%	1.8E-10	8.6E-25	0.7%	1.3E+00	2.3E-10
0	0.0%	-1.3E-10	0.0E+00	0.0%	1.0E+00	2.3E-10

0	0.0%	-1.1E-10	0.0E+00	0.0%	1.0E+00	2.3E-10
0	0.0%	2.0E-10	0.0E+00	0.0%	1.0E+00	2.3E-10
0	0.0%	3.0E-11	0.0E+00	0.0%	1.0E+00	2.3E-10
0.33	2.1%	4.9E-12	2.6E-24	2.1%	1.6E+01	2.3E-10
0.0064	17.8%	2.9E-10	3.4E-24	2.8%	-3.0E-02	2.3E-10
0.41	3.6%	-9.3E-12	1.5E-23	12.0%	1.2E+01	2.3E-10
0.49	0.9%	-6.8E-14	1.1E-27	0.0%	5.5E+01	2.3E-10
0.58	4.4%					
0.060	3.0%	1.5E-11	8.5E-25	0.7%	2.1E+00	2.3E-10
6.9	5.1%	6.4E-15	2.0E-27	0.0%	1.4E+02	2.3E-10
0.095	4.1%					
0.0085	2.5%	6.8E-10	3.3E-23	26.7%	3.5E-01	2.4E-10
0.017	1.9%	2.7E-10	2.0E-23	16.1%	8.8E-01	2.4E-10
0.00005	0.6%	2.7E-08	1.9E-24	1.5%	8.5E-03	2.3E-10
0.00005	0.0%	-9.7E-10	2.3E-27	0.0%	2.4E-01	2.3E-10
0.000046	1.0%	5.0E-08	5.4E-24	4.4%	4.6E-03	2.3E-10
1.2	1.2%	-2.3E-12	7.9E-24	6.4%	1.0E+02	2.3E-10

u_c(y)

u_{cr}(y)

Σ

1.1E-11	4.8%	100.0%

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for sensit coeff			
u(x _i)	u _r (x _i)	c _i	u ² _y (x _i)		$x_i + u(x_i)$	$y(x_i+u(x_i))$		
0.043	0.20/	2 05 01		72 40/	4 25 04			
0.043	9.2%	3.0E-01	5.5E-U5	73.4%	-4.3E-UI	3.0E-01		
0.057	1.8%	0.0E+00	0.0E+00	0.0%	-3.2E+00	3.4E-01		
0.020	4.8%	-8.1E-01	-3.1E-05	-42.4%	4.2E-01	3.3E-01		
0.0022	6.9%	-3.3E+00	9.1E-06	12.6%	-3.0E-02	3.4E-01		
0.000075	13.1%	-1.1E+01	-7.5E-07	-1.0%	6.5E-04	3.4E-01		
0.00012	0.0%	-2.5E-01	8.3E-10	0.0%	1.2E+00	3.4E-01		
0.00012	0.0%	9.2E-01	1.1E-08	0.0%	3.1E-01	3.4E-01		
0.29		1.5E-02	1.8E-05	25.7%	2.9E-01	3.5E-01		
0.29		-1.7E-02	2.3E-05	31.7%	2.9E-01	3.4E-01		
0.0000	0.0%							
0.0000	0.0%							
0.0000	0.0%							
0.0000	0.0%							
0.0000	0.0%							
0.0000	0.0%							

	0.0000	0.0%					
	0.005	11.5%	0.0E+00	0.0E+00	0.0%	4.8E-02	3.4E-01
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.4E-02	3.4E-01
u _c (y)	u _{c r}	(y)		Σ			
	0.008	2.5%			100.0%		

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	$u_y^2(\mathbf{x}_i)$		x _i +u(x _i)	$y(x_i+u(x_i))$
0.043	9.2%	-0.1908	1.7E-05	6.3%	-4.3E-01	8.5E-01
0.057	1.8%	-0.1385	-1.4E-05	-5.2%	-3.2E+00	8.5E-01
0.020	4.8%	-0.0496	1.4E-06	0.5%	4.2E-01	8.6E-01
0.0022	6.9%	0.5942	1.7E-06	0.6%	-3.0E-02	8.6E-01
0.000075	13.1%	7.6348	-6.7E-07	-0.2%	6.5E-04	8.6E-01
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0.12	0.0%	0.0001	1.2E-10	0.0%	1.3E+03	8.6E-01
0.012	1.2%	-0.1434	2.7E-06	1.0%	1.0E+00	8.6E-01
0.012	1.2%	-0.1434	2.7E-06	1.0%	1.0E+00	8.6E-01
0.023	11.5%	0.7385	2.7E-04	99.4%	2.2E-01	8.8E-01
0.12	0.1%	0.0001	6.1E-11	0.0%	8.7E+01	8.6E-01
0.01%	0.6%	0.2432	7.9E-10	0.0%	2.1E-02	8.6E-01
0.079	11.5%	-0.0074	-9.5E-06	-3.5%	7.6E-01	8.6E-01
0.012	1.2%	0.0051	3.5E-09	0.0%	9.9E-01	8.6E-01
0.012	2.1%	0.0091	1.1E-08	0.0%	5.6E-01	8.6E-01
0.12%	0.3%	-0.0129	2.2E-10	0.0%	3.9E-01	8.6E-01

u_c(γ) u_r(γ)

Σ

0.017 1.9%

100.0%

t	., / s	t _I / s	t _{dead r} / %	ő t _d /	/ s	t _c / t _{1/2}	t _d / t _{1/2}	
	1202620	1264269	2	20/	2404405			1

10:39 AM	1292628	1264268	2.2%	2404405	0.55	1.0
4:52 PM	797	740	7.2%	3722775	0.00	0.0

Correlation matrix of ρ_{a}

$x_i - u(x_i)$	$y(x_i - u(x_i))$						
			t _i	μ	t _{1/2 a}	t _{1/2 m}	
2.2E+04	2.3E-10	t _i		1	0	0	0
4.4E-02	2.3E-10	μ		0	1	0	0
2.3E+06	2.3E-10	t _{1/2 a}		0	0	1	0
		t _{1/2 m}		0	0	0	1
1.7E+08	2.3E-10	t _{d a}		0	0	0	0
		t _{ca}		0	0	0	0
2.4E+06	2.3E-10	t _{la}		0	0	0	0
1.3E+06	2.3E-10	t _{d m}		0	0	0	0
1.3E+06	2.3E-10	t _{c m}		0	0	0	0
3.7E+06	2.3E-10	t _{l m}		0	0	0	0
8.0E+02	2.3E-10	n _{pa}		0	0	0	0
7.4E+02	2.3E-10	n _{p m}		0	0	0	0
		k _{o Au} (a)		0	0	0	0
		k _{o Au} (m)		0	0	0	0
		${\sf G}_{\sf tha}$		0	0	0	0
		G _{e a}		0	0	0	0
9.9E+04	2.3E-10	G _{th m}		0	0	0	0
1.4E+05	2.3E-10	G _{e m}		0	0	0	0
2.5E-02	2.3E-10	f		0	0	0	0
1.3E+00) 2.3E-10	α		0	0	0	0
1.0E+00) 2.3E-10	Q_{0a}		0	0	0	0

1.0E+00	2.3E-10	E _{ra}	0	0	0	0
1.0E+00	2.3E-10	Q _{0 m}	0	0	0	0
1.0E+00	2.3E-10	E _{rm}	0	0	0	0
1.5E+01	2.3E-10	ε_{pm}^{eo} / ε_{pa}^{b}	0	0	0	0
-4.2E-02	2.3E-10	COI _m / COI _a	0	0	0	0
1.1E+01	2.4E-10	m _m	0	0	0	0
5.4E+01	2.3E-10	m _a	0	0	0	0
		W _m	0	0	0	0
1.9E+00	2.3E-10	υ	0	0	0	0
1.3E+02	2.3E-10					
3.3E-01	2.3E-10					

8.5E-01	2.3E-10
8.4E-03	2.3E-10
2.4E-01	2.3E-10
4.6E-03	2.3E-10
9.8E+01	2.3E-10

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

			a ₁		a ₀	a ₋₁	a ₋₂
-5.2E-01	3.3E-01	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	3.4E-01	a ₀	1	-0.973	1.000	-0.957	0.896
3.8E-01	3.6E-01	a-	1	0.884	-0.957	1.000	-0.984
-3.4E-02	3.5E-01	a_;	2	-0.804	0.896	-0.984	1.000
5.0E-04	3.4E-01	a-:	3	0.748	-0.848	0.957	-0.993
1.2E+00	3.4E-01	Eγ	m	0	0	0	0
3.1E-01	3.4E-01	Eγ	a	0	0	0	0
-2.9E-01	3.4E-01	Δα	d _a	0	0	0	0
-2.9E-01	3.5E-01	Δα	d _m	0	0	0	0
		δε	ra	0	0	0	0
		δε	r m	0	0	0	0

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of $\text{COI}_{\rm m}$ / $\text{COI}_{\rm a}$

			a_1		a ₀		a ₋₁		a ₋₂	
8.7E-01	i	a ₁		1.000	-0.	973		0.884		-0.804
8.7E-01	;	a ₀		-0.973	1.	000	-	0.957		0.896
8.6E-01	;	a ₋₁		0.884	-0.	957		1.000		-0.984
8.6E-01	;	a ₋₂		-0.804	0.	896	-	0.984		1.000
8.6E-01	i	a ₋₃		0.748	-0.	848		0.957		-0.993
	ļ	E _{γ2 m}		0		0		0		0
	;	a _{γ2 m}		0		0		0		0
		C _{γ2 m}		0		0		0		0
		Ρ/Τ_{γ2 m}		0		0		0		0
	l	Ε _{γ6 a}		0		0		0		0
8.6E-01		P _{γ6 a}		0		0		0		0
8.6E-01		Ρ/Τ _{γ6 a}		0		0		0		0
8.6E-01	i	a _{γ9 a}		0		0		0		0
8.4E-01		C _{γ9 a}		0		0		0		0
8.6E-01		P _{γ9a}		0		0		0		0
8.6E-01										
8.6E-01										
8.6E-01										
	8.7E-01 8.7E-01 8.6E-01 8.6E-01 8.6E-01 8.6E-01 8.6E-01 8.4E-01 8.6E-01 8.6E-01 8.6E-01 8.6E-01 8.6E-01 8.6E-01 8.6E-01	8.7E-01 8.7E-01 8.6E-01 8.6E-01 8.6E-01 8.6E-01 8.6E-01 8.4E-01 8.6E-01 8.6E-01 8.6E-01 8.6E-01 8.6E-01 8.6E-01	$8.7E-01$ a_1 $8.7E-01$ a_0 $8.6E-01$ $a_{.1}$ $8.6E-01$ $a_{.2}$ $8.6E-01$ $a_{.3}$ $E_{\gamma 2 m}$ $a_{\gamma 2 m}$ $C_{\gamma 2 m}$ $P/T_{\gamma 2 m}$ $E_{\gamma 6 a}$ $E_{\gamma 6 a}$ $8.6E-01$ $P/T_{\gamma 6 a}$ $8.6E-01$ $a_{\gamma 9 a}$ $8.6E-01$ $C_{\gamma 9 a}$ $8.6E-01$ $P_{\gamma 9 a}$ $8.6E-01$ $P_{\gamma 9 a}$ $8.6E-01$ $8.6E-01$ $8.6E-01$ $8.6E-01$ $8.6E-01$ $8.6E-01$	a_1 $8.7E-01$ a_0 $8.7E-01$ a_0 $8.6E-01$ a_{-1} $8.6E-01$ a_2 $8.6E-01$ a_3 $E_{\gamma 2 m}$ $a_{\gamma 2 m}$ $C_{\gamma 2 m}$ $P/T_{\gamma 2 m}$ $E_{\gamma 6 a}$ $8.6E-01$ $8.6E-01$ $P/T_{\gamma 6 a}$ $8.6E-01$ $a_{\gamma 9 a}$ $8.6E-01$ $C_{\gamma 9 a}$ $8.6E-01$ $R_{\gamma 9 a}$	a_1 1.000 $8.7E-01$ a_0 -0.973 $8.6E-01$ a_{-1} 0.884 $8.6E-01$ a_{-2} -0.804 $8.6E-01$ a_{-2} -0.804 $8.6E-01$ a_{-3} 0.748 $E_{\gamma 2 m}$ 0 $a_{\gamma 2 m}$ 0 $C_{\gamma 2 m}$ 0 $P/T_{\gamma 2 m}$ 0 $8.6E-01$ $P_{\gamma 6 a}$ 0 $8.6E-01$ $a_{\gamma 9 a}$ 0 $8.6E-01$ $P_{\gamma 9 a}$ 0 $8.6E-01$ $P_{\gamma 9 a}$ 0 $8.6E-01$ $R_{\gamma 9 a}$ 0	a_1 a_0 $8.7E-01$ a_1 1.000 -0.3 $8.7E-01$ a_0 -0.973 1.3 $8.6E-01$ a_{-1} 0.884 -0.3 $8.6E-01$ a_{-2} -0.804 0.3 $8.6E-01$ a_{-2} -0.804 0.3 $8.6E-01$ a_{-2} -0.804 0.3 $6_{\gamma 2} m$ 0 -0.33 -0.33 $6_{\gamma 2} m$ 0 -0.33 -0.33 $6_{\gamma 2} m$ 0 -0.33 -0.33 $8.6E-01$ $P_{\gamma 6} a$ 0 -0.33 $8.6E-01$ $P_{\gamma 9} a$ 0 -0.33 $8.6E-01$ $P_{\gamma 9} a$ 0 -0.33 $8.6E-01$ $P_{\gamma 9} a$ 0 -0.33 $8.6E-01$ -0.33 -0.33 -0.33 $8.6E-01$ -0.333 -0.333 -0.333 $8.6E-01$ -0.333 -0.333 $8.6E-01$ -0.333 -0.3333 $8.6E-01$ -0.3333 -0.3333 $8.6E-01$ -0.3333 -0.33333 $8.6E-01$ -0.333333 -0.3333333333 $8.6E-01$ $-0.333333333333333333333333333333333333$	a_1 a_0 $8.7E-01$ a_1 1.000 -0.973 $8.7E-01$ a_0 -0.973 1.000 $8.6E-01$ $a_{.1}$ 0.884 -0.957 $8.6E-01$ $a_{.2}$ -0.804 0.896 $8.6E-01$ $a_{.3}$ 0.748 -0.848 $E_{\gamma 2 m}$ 0 0 $a_{\gamma 2 m}$ 0 0 $C_{\gamma 2 m}$ 0 0 $P/T_{\gamma 2 m}$ 0 0 $8.6E-01$ $P_{\gamma 6 a}$ 0 $8.6E-01$ $a_{\gamma 9 a}$ 0 $8.6E-01$ $P_{\gamma 9 a}$ 0 $8.6E-01$ $R_{\gamma 9 a}$ 0 $8.6E-01$ $8.6E-01$ $R_{\gamma 9 a}$ $8.6E-01$ $R_{\gamma 9 a}$ 0	a_1 a_0 a_1 $8.7E-01$ a_0 -0.973 1.000 -0.973 $8.7E-01$ a_0 -0.973 1.000 -0.973 $8.6E-01$ a_1 0.884 -0.957 -0.804 $8.6E-01$ a_2 -0.804 0.896 -0.848 $8.6E-01$ a_3 0.748 -0.848 $E_{\gamma 2 m}$ 0 0 -0.973 $8.6E-01$ a_72m 0 0 $P/T_{\gamma 2 m}$ 0 0 $8.6E-01$ $P_{\gamma 6 a}$ 0 $8.6E-01$ $A_{\gamma 9 a}$ 0 $8.6E-01$ $P_{\gamma 9 a}$ 0 $8.6E-01$ $R_{\gamma 9 a}$ $R_{\gamma 9 a}$ $8.6E-01$ $R_{\gamma 9 a}$ $R_$	a_1 a_0 a_1 $8.7E-01$ a_1 1.000 -0.973 0.884 $8.7E-01$ a_0 -0.973 1.000 -0.957 $8.6E-01$ $a_{.1}$ 0.884 -0.957 1.000 $8.6E-01$ $a_{.2}$ -0.804 0.896 -0.984 $8.6E-01$ $a_{.2}$ -0.804 0.896 -0.984 $8.6E-01$ $a_{.2}$ -0.804 0.957 0.00 $a_{.72m}$ 0 0 0 0 $a_{.72m}$ 0 0 0 0 $a_{.72m}$ 0 0 0 0 $B_{.76a}$ 0 0 0 0 $8.6E-01$ $P_{.76a}$ 0 0 0 $8.6E-01$ $a_{.79a}$ 0 0 0 $8.6E-01$ $P_{.79a}$ 0 0 0 $8.6E-01$ $R_{.79a}$ 0 0 0 $R_{.79a}$ 0 0 0 0 $R_{.79a}$ 0 0 0 0 </td <td>$a_1$$a_0$$a_1$$a_2$8.7E-01$a_0$-0.9731.000-0.9578.6E-01$a_1$0.884-0.9571.0008.6E-01$a_2$-0.8040.896-0.9848.6E-01$a_3$0.748-0.8480.957$E_{\gamma 2 m}000a_{\gamma 2 m}000P/T_{\gamma 2 m}000E_{\gamma 6 a}$0008.6E-01$a_{\gamma 9 a}$008.6E-01$a_{\gamma 9 a}$008.6E-01$P_{\gamma 9 a}$008.6E-01$P_{\gamma 9 a}$008.6E-01$R_{9 a}$008.</td>	a_1 a_0 a_1 a_2 8.7E-01 a_0 -0.9731.000-0.9578.6E-01 a_1 0.884-0.9571.0008.6E-01 a_2 -0.8040.896-0.9848.6E-01 a_3 0.748-0.8480.957 $E_{\gamma 2 m}$ 000 $a_{\gamma 2 m}$ 000 $P/T_{\gamma 2 m}$ 000 $E_{\gamma 6 a}$ 0008.6E-01 $a_{\gamma 9 a}$ 008.6E-01 $a_{\gamma 9 a}$ 008.6E-01 $P_{\gamma 9 a}$ 008.6E-01 $P_{\gamma 9 a}$ 008.6E-01 $R_{9 a}$ 008.

5.4E-01 8.6E-01

3.8E-01 8.6E-01

t _{d a}	t _{ca}	t _{la}	t _{d m}	t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)	
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
		-	0	0	0	0	0	0	
---	---	---	---	---	---	---	---	---	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	

a_3	$E_{\gamma m}$	$E_{\gamma a}$	$\Delta {\rm d_a}$	Δd_{m}	$\delta\epsilon_{ra}$	δε _{r m}		Ci
0.748	3	0	0	0	0	0	0	3.0E-01
-0.848	3	0	0	0	0	0	0	0.0E+00
0.95	7	0	0	0	0	0	0	-8.1E-01
-0.993	3	0	0	0	0	0	0	-3.3E+00
1.000)	0	0	0	0	0	0	-1.1E+01
()	1	0	0	0	0	0	-2.5E-01
()	0	1	0	0	0	0	9.2E-01
()	0	0	1	0	0	0	1.5E-02
()	0	0	0	1	0	0	-1.7E-02
()	0	0	0	0	1	1	0.0E+00
()	0	0	0	0	1	1	0.0E+00

a ₋₃	$E_{\gamma 2 m}$	a _{γ2 m}	$c_{\gamma 2 m}$	P /T _{γ2 m}	Ε _{γ6 a}	Ρ _{γ6 a}	Ρ/Τ _{γ6 a}	$a_{\gamma 9 a}$	
0.748	0) (0 (D	0	0	0	0	0
-0.848	0) (0 (0	0	0	0	0	0
0.957	0) (0 (0	0	0	0	0	0
-0.993	0) (0 (D	0	0	0	0	0
1.000	0) (0 (0	0	0	0	0	0
0	1	. (0 (0	0	0	0	0	0
0	0)	1 (0	0	0	0	0	0
0	0) (0 2	1	0	0	0	0	0
0	0) (0 (0	1	0	0	1	0
0	0) (0 (0	0	1	0	0	0
0	0) (0 (C	0	0	1	0	0
0	0) (0 (C	1	0	0	1	0
0	0) (0 (C	0	0	0	0	1
0	0) (0 (D	0	0	0	0	0
0	0) (0 0	C	0	0	0	0	0

k _{0 Au} (m)	G_{tha}	G_{ea}	G_{thm}	G _{e m}	f	α	Q_{0a}	E _{ra}	
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0

0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Covariance matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

	a ₁	a ₀	a_1	a_2	a_3	$E_{\gamma m}$	$E_{\gamma a}$
a ₁	1.9E-03	-2.4E-03	7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00
a ₀	-2.4E-03	3.2E-03	-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00
a_1	7.5E-04	-1.1E-03	3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00
a_2	-7.7E-05	1.1E-04	-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00
a_3	2.4E-06	-3.6E-06	1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00
$E_{\gamma m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08	0.0E+00
$E_{\gamma a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08
$\Delta {\rm d_a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\Delta d_{\rm m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\delta\epsilon_{ra}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
δε _{r m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	3.0E-01	0.0E+00	-8.1E-01	-3.3E+00	-1.1E+01	-2.5E-01	9.2E-01

Ci

$c_{\gamma 9 a}$	Ρ _{γ9 a}		Ci		a ₁	a ₀	a ₋₁
	0	0	-1.9E-01	a ₁	1.9E-03	-2.4E-03	7.5E-04
	0	0	-1.4E-01	a ₀	-2.4E-03	3.2E-03	-1.1E-03
	0	0	-5.0E-02	a_1	7.5E-04	-1.1E-03	3.8E-04
	0	0	5.9E-01	a_2	-7.7E-05	1.1E-04	-4.3E-05
	0	0	7.6E+00	a_3	2.4E-06	-3.6E-06	1.4E-06
	0	0	9.7E-05	$E_{\gamma 2} m$	0.0E+00	0.0E+00	0.0E+00
	0	0	-1.4E-01	$a_{\gamma 2} m$	0.0E+00	0.0E+00	0.0E+00
	0	0	-1.4E-01	$C_{\gamma 2} m$	0.0E+00	0.0E+00	0.0E+00
	0	0	7.4E-01	$P/T_{\gamma 2 m}$	0.0E+00	0.0E+00	0.0E+00
	0	0	6.8E-05	$E_{\gamma 6 a}$	0.0E+00	0.0E+00	0.0E+00
	0	0	2.4E-01	$P_{\gamma 6 a}$	0.0E+00	0.0E+00	0.0E+00
	0	0	-7.4E-03	$P/T_{\gamma 6 a}$	0.0E+00	0.0E+00	0.0E+00
	0	0	5.1E-03	$a_{\gamma9a}$	0.0E+00	0.0E+00	0.0E+00
	1	0	9.1E-03	C _{y9 a}	0.0E+00	0.0E+00	0.0E+00
	0	1	-1.3E-02	$P_{\gamma 9 a}$	0.0E+00	0.0E+00	0.0E+00

Covariance matrix of COI_m/COI_a

c_i -1.9E-01 -1.4E-01 -5.0E-02

Q _{0 m}	E _{rm}	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	° COI _m / CO	I _a m _m	m _a	w _m	
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

0	0	0	0	0	0	0
1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	1	0
0	0	0	0	0	0	1
0	0	0	0	0	0	0

Δd_a	Δd_m	δε _{r a}		δε _{r m}	
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
8.3E-02	0.0E+00		0.0E+00		0.0E+00
0.0E+00	8.3E-02		0.0E+00		0.0E+00
0.0E+00	0.0E+00		2.5E-05		2.8E-05
0.0E+00	0.0E+00		2.8E-05		3.1E-05
1.5E-02	-1.7E-02		0.0E+00		0.0E+00

		_				_
a_2	a_3	$E_{\gamma 2} m$	a _{γ2 m}	C _{γ2 m}	P/T _{γ2 m}	E _{γ6 a}
-7.7E-05	2.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.1E-04	-3.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-4.3E-05	1.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4.9E-06	-1.7E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.7E-07	5.7E-09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	1.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-04	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-02
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-03	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
5.9E-01	7.6E+00	9.7E-05	-1.4E-01	-1.4E-01	7.4E-01	6.8E-05

Covariance matrix of ρ_{a}

	с _і		t _i	μ	
0	3.4E-17	t _i		3.0E+02	0.0E+00
0	-1.1E-11	μ		0.0E+00	2.5E-07
0	1.0E-17	t _{1/2 a}		0.0E+00	0.0E+00
0	-1.4E-18	t _{1/2 m}		0.0E+00	0.0E+00
0	6.9E-17	t _{d a}		0.0E+00	0.0E+00
0	4.0E-17	t _{c a}		0.0E+00	0.0E+00
0	-1.9E-16	t _{l a}		0.0E+00	0.0E+00
0	-9.7E-19	t _{d m}		0.0E+00	0.0E+00
0	-1.2E-14	t _{c m}		0.0E+00	0.0E+00
0	3.3E-13	t _{l m}		0.0E+00	0.0E+00
0	2.3E-15	n _{pa}		0.0E+00	0.0E+00
0	-1.7E-15	n _{p m}		0.0E+00	0.0E+00
0	-9.2E-09	k _{o Au} (a)		0.0E+00	0.0E+00
0	1.8E-10	k _{o Au} (m)		0.0E+00	0.0E+00
0	-1.3E-10	G_{tha}		0.0E+00	0.0E+00
0	-1.1E-10	G _{ea}		0.0E+00	0.0E+00
0	2.0E-10	G _{th m}		0.0E+00	0.0E+00
0	3.0E-11	G _{e m}		0.0E+00	0.0E+00
0	4.9E-12	f		0.0E+00	0.0E+00
0	2.9E-10	CL		0.0E+00	0.0E+00
0	-9.3E-12	Q _{0 a}		0.0E+00	0.0E+00

0	-6.8E-14	E _{ra}	0.0E+00	0.0E+00
0	1.5E-11	Q _{0 m}	0.0E+00	0.0E+00
0	6.4E-15	Erm	0.0E+00	0.0E+00
0	6.8E-10	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	0.0E+00	0.0E+00
0	2.7E-10	COI _m / COI _a	0.0E+00	0.0E+00
0	2.7E-08	m _m	0.0E+00	0.0E+00
0	-9.7E-10	m _a	0.0E+00	0.0E+00
0	5.0E-08	W _m	0.0E+00	0.0E+00
1	-2.3E-12	υ	0.0E+00	0.0E+00

c_i 3.4E-17 -1.1E-11

$P_{\gamma 6 a}$	F	Ρ/Τ _{γ6 a}	$a_{\gamma9a}$	C _{y9 a}	$P_{\gamma 9 a}$
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	1.8E-03	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	1.3E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	6.2E-03	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-06
	2.4E-01	-7.4E-03	5.1E-03	9.1E-03	-1.3E-02

t _{1/2 a}	t _{1/2 m}	t _{d a}	t _{ca}	t _{l a}	t _{d m}	
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	3.0E+04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	6.7E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.2E+03	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E+03
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.0E-17	-1.4E-18	6.9E-17	4.0E-17	-1.9E-16	-9.7E-19

t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)	k _{o Au} (m)
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	6.0E+06	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	1.9E+05	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-08	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-05
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.2E-14	3.3E-13	2.3E-15	-1.7E-15	-9.2E-09	1.8E-10

1	~		
(-		
	-	÷	2

G _{e a}	G _{th m}	G _{em}	f	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-01
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.3E-10	-1.1E-10	2.0E-10	3.0E-11	4.9E-12

CL	Q _{0 a}	E _{ra}	Q _{0 m}	E _{rm}	ε _{p m}	^{geo} / ε _{pa} geo
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	4.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	1.7E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.	0E+00	0.0E+00	2.4E-01	0.0E+00	0.0E+00	0.0E+00
0.	0E+00	0.0E+00	0.0E+00	3.6E-03	0.0E+00	0.0E+00
0.	0E+00	0.0E+00	0.0E+00	0.0E+00	4.8E+01	0.0E+00
0.	0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.2E-05
0.	0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.	0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.	0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.	0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.	0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.	9E-10	-9.3E-12	-6.8E-14	1.5E-11	6.4E-15	6.8E-10

COI _m / COI _a	m _m		m _a	W _m	υ
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	
2.7E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	
0.0E+00	2.5E-09	0.0E+00	0.0E+00	0.0E+00	
0.0E+00	0.0E+00	2.5E-09	0.0E+00	0.0E+00	
0.0E+00	0.0E+00	0.0E+00	2.1E-09	0.0E+00	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E+00	
2.7E-10	2.7E-08	-9.7E-10	5.0E-08	-2.3E-12	

Irradiation and γ -spectrometry

end irradiation	9/12/2017	2.46 PM
irradiation time / s	21600	

library	CSF.Lib
calib	OR50_source2016_geom_cont_12052017.Clb
sm type	CSF.Lib (ROI32 Analysis)

Nuclide	Channel		Energy		Background	
51Cr		1279.1		320.1		1066118
Co60		4691.96		1173.2		5220
	target		product	:		
analite, a	⁵⁰ Cr		⁵¹ Cr			
monitor, m	⁵⁹ Co		⁶⁰ Co			

Uncertainty budget of ρ_{a}

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
t _i		S	21600
μ		1	0.0445
t _{1/2 a}		S	2393280
	λ_{a}	s ⁻¹	2.89622E-07
t _{1/2 m}		S	166345920
	λ_{m}	s ⁻¹	4.16690E-09
t _{d a}		S	2.404405E+06
t _{ca}		S	1.29262800E+06
t _{la}		S	1.26426800E+06
t _{d m}		S	3.722775E+06
t _{c m}		S	7.9700E+02
t _{l m}		S	7.4000E+02
	δ_{a}	1	1.022
	δ_{m}	1	1.077
	ξa	1	1.00098
	ξm	1	1.00319
n _{pa}		1	5.26E+04
n _{pm}		1	1.3749E+05
k _{o Au} (a)		1	2.620E-03
k _{0 Au} (m)		1	1.3200
G _{th a}		1	1

G _{e a}		1		1
G _{th m}		1		1
G _{e m}		1		1
f		1		15.60
α		1		-0.0360
Q _{0 a}		1		0.53
E _{ra}		eV		7530
	$Q_{0a}(\alpha)$	1		0.59
Q _{0 m}		1		1.993
E _{r m}		eV		136.0
	Q _{0 m} (α)	1		2.319
ε_{pm}^{geo} / ε_{pa}^{geo}		1		0.3507
COI_m / COI_a		1		0.857
m _m		g		0.00847
m _a		g		0.24000
W _m		g g ⁻¹		0.004597
υ		$mg L^{-1}$		99.2
Y		[Y]	у	
$ ho_{a}$		g mL ⁻¹		2.096E-09

Uncertainty budget of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
a ₁		Mev-1	-0.472
a ₀			1 -3.229
a ₋₁		Mev	0.403
a ₋₂		Mev2	-0.0320
a ₋₃		Mev3	0.000573
E _{γm}		MeV	1.17320
$E_{\gamma a}$		MeV	0.32010
Δd_{a}		mm	0.00
Δd_m		mm	0.00
	e ₄	keV-4	-7.10E-11
	e ₃	keV-3	5.19E-08
	e ₂	keV-2	-1.43E-05
	e ₁	keV-1	1.78E-03
	e ₀		1 -4.46E-02
	d_1	keV-1	5.56E-06

d _o	:	1	4.17E-02
δε _{ra}	mm⁻¹		0.043
δε _{rm}	mm ⁻¹		0.048
v	[Y]	V	
	[']	Ŷ	
ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	1		0.3507

Uncertainty budget of COI_{m} / COI_{a}

Input Quantity	Quantity	Unit	Value	
	X _i	[X _i]	x _i	
a ₁		Mev-1		-0.472
a ₀			1	-3.229
a_1		Mev		0.403
a ₋₂		Mev2		-0.0320
a ₋₃		Mev3		0.000573
	b ₁		1	-0.571
	b ₀		1	1.079
	C ₂		1	-1.625
	C ₁		1	6.678
	c ₀		1	-7.006
E _{γ2 m}		keV		1332.50
a _{γ2 m}			1	1.000
$c_{\gamma 2 m}$			1	1.000
Ρ/Τ _{γ2 m}			1	0.197
	Y	[Y]	У	
	COI _m / COI _a		1	0.857

start counting	ource file	VHM	% FW	Uncert %	Cnts/s		Net area
10/10/2017	DR50_20171025_CSF_s	1.277	2.81	2 2	0.042	52632	
10/25/2017	DR50_20170925_Co_sa	1.798	0.32	9 (185.919	137487	

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	u ^r _y (x _i)		$x_i + u(x_i)$	y(x _i +u(x _i))
17	0.1%	3.0E-16	2.7E-29	0.0%	2.2E+04	2.1E-09
0.0005	1.1%	-1.0E-10	2.7E-27	0.0%	4.5E-02	2.1E-09
207	0.0%	1.1E-16	5.2E-28	0.0%	2.4E+06	2.1E-09
2.5E-11	0.0%					
25920	0.0%	-1.2E-17	1.0E-25	0.0%	1.7E+08	2.1E-09
6.5E-13	0.0%					
3.5E+01	0.0%	6.1E-16	4.4E-28	0.0%	2.4E+06	2.1E-09
2.9E-01	0.0%	3.6E-16	1.1E-32	0.0%	1.3E+06	2.1E-09
2.9E-01	0.0%	-1.7E-15	2.5E-31	0.0%	1.3E+06	2.1E-09
3.5.E+01	0.0%	-8.7E-18	9.2E-32	0.0%	3.7E+06	2.1E-09
2.9E-01	0.0%	-1.1E-13	9.8E-28	0.0%	8.0E+02	2.1E-09
2.9E-01	0.0%	2.9E-12	7.2E-25	0.0%	7.4E+02	2.1E-09
0.000	0.0%					
0.001	0.1%					
0.00001	0.0%					
0.00004	0.0%					
1.5E+03	2.8%	4.0E-14	3.5E-21	35.3%	5.4E+04	2.2E-09
4.4E+02	0.3%	-1.5E-14	4.5E-23	0.5%	1.4E+05	2.1E-09
1.3E-05	0.5%	-8.0E-07	1.1E-22	1.1%	2.6E-03	2.1E-09
0.0053	0.4%	1.6E-09	7.0E-23	0.7%	1.3E+00	2.1E-09
0	0.0%	-2.0E-09	0.0E+00	0.0%	1.0E+00	2.1E-09

0	0.0%	-7.7E-11	0.0E+00	0.0%	1.0E+00	2.1E-09
0	0.0%	1.8E-09	0.0E+00	0.0%	1.0E+00	2.1E-09
0	0.0%	2.7E-10	0.0E+00	0.0%	1.0E+00	2.1E-09
0.33	2.1%	-1.2E-11	1.7E-23	0.2%	1.6E+01	2.1E-09
0.0064	17.8%	-9.0E-10	3.3E-23	0.3%	-3.0E-02	2.1E-09
0.11	20.0%	-1.8E-10	3.6E-22	3.6%	6.4E-01	2.1E-09
828	11.0%	-8.7E-17	5.1E-27	0.0%	8.4E+03	2.1E-09
0.15	24.8%					
0.060	3.0%	1.4E-10	7.0E-23	0.7%	2.1E+00	2.1E-09
6.9	5.1%	5.8E-14	1.6E-25	0.0%	1.4E+02	2.1E-09
0.095	4.1%					
0.0087	2.5%	6.0E-09	2.7E-21	27.4%	3.6E-01	2.1E-09
0.017	2.0%	2.4E-09	1.7E-21	17.6%	8.7E-01	2.1E-09
0.00005	0.6%	2.5E-07	1.5E-22	1.6%	8.5E-03	2.1E-09
0.00005	0.0%	-8.7E-09	1.9E-25	0.0%	2.4E-01	2.1E-09
0.000046	1.0%	4.6E-07	4.4E-22	4.5%	4.6E-03	2.1E-09
1.2	1.2%	-2.1E-11	6.4E-22	6.5%	1.0E+02	2.1E-09

u_c(y)

u_{cr}(y)

Σ

9.9E-11	4.7%	100.0%

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	c _i	u ² _y (x _i)		$x_i + u(x_i)$	$y(x_i+u(x_i))$
0.043	9.2%	3.0E-01	5.6E-05	74.1%	-4.3E-01	3.6E-01
0.057	1.8%	0.0E+00	0.0E+00	0.0%	-3.2E+00	3.5E-01
0.020	4.8%	-8.0E-01	-3.3E-05	-43.1%	4.2E-01	3.4E-01
0.0022	6.9%	-3.2E+00	9.8E-06	12.9%	-3.0E-02	3.4E-01
0.000075	13.1%	-1.0E+01	-8.1E-07	-1.1%	6.5E-04	3.5E-01
0.00012	0.0%	-2.5E-01	8.7E-10	0.0%	1.2E+00	3.5E-01
0.00012	0.0%	9.2E-01	1.1E-08	0.0%	3.2E-01	3.5E-01
0.29		1.5E-02	1.9E-05	25.6%	2.9E-01	3.6E-01
0.29		-1.7E-02	2.4E-05	31.5%	2.9E-01	3.5E-01
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					

	0.0087	2.5%			100.0%		
u _c (y)	U _{c r}	(y)		Σ			
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.4E-02	3.5E-01
	0.005	11.5%	0.0E+00	0.0E+00	0.0%	4.8E-02	3.5E-01
	0.0000	0.0%					

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	c _i	$u_y^2(x_i)$		x _i +u(x _i)	$y(x_i+u(x_i))$
0.043	9.2%	-1.9E-01	1.7E-05	5.9%	-4.3E-01	8.5E-01
0.057	1.8%	-1.4E-01	-1.4E-05	-4.9%	-3.2E+00	8.5E-01
0.020	4.8%	-1.1E-01	3.0E-06	1.0%	4.2E-01	8.6E-01
0.0022	6.9%	-8.0E-02	-2.2E-07	-0.1%	-3.0E-02	8.6E-01
0.000075	13.1%	-6.0E-02	5.0E-09	0.0%	6.5E-04	8.6E-01
C	0.0%					
C	0.0%					
C	0.0%					
C	0.0%					
C	0.0%					
0.12	0.0%	9.6E-05	1.2E-10	0.0%	1.3E+03	8.6E-01
0.012	1.2%	-1.4E-01	2.7E-06	0.9%	1.0E+00	8.6E-01
0.012	1.2%	-1.4E-01	2.7E-06	0.9%	1.0E+00	8.6E-01
0.023	11.5%	7.3E-01	2.8E-04	96.2%	2.2E-01	8.7E-01
u _c (y)	u _r (y)			Σ		

0.017 2.0% 100.0%

t,	_ / s	t _I / s	t _{dead r} / %	t _d /	s s	t _c / t _{1/2}	t _d / t _{1/2}	
~~ • • •	4000000	4064060		~ (0 =		

10:39 AM	1292628	1264268	2.2%	2404405	0.54	1.0	
4:52 PM	797	740	7.2%	3722775	0.00	0.0	

Correlation matrix of ρ_{a}

$x_i - u(x_i)$	$y(x_i - u(x_i))$						
			t _i	μ	t _{1/2 a}	t _{1/2 m}	
2.2E+04	2.1E-09	t _i		1	0	0	0
4.4E-02	2.1E-09	μ		0	1	0	0
2.4E+06	5 2.1E-09	t _{1/2 a}		0	0	1	0
		t _{1/2 m}		0	0	0	1
1.7E+08	2.1E-09	t _{d a}		0	0	0	0
		t _{ca}		0	0	0	0
2.4E+06	5 2.1E-09	t _{la}		0	0	0	0
1.3E+06	5 2.1E-09	t _{d m}		0	0	0	0
1.3E+06	5 2.1E-09	t _{c m}		0	0	0	0
3.7E+06	5 2.1E-09	t _{l m}		0	0	0	0
8.0E+02	2.1E-09	n _{pa}		0	0	0	0
7.4E+02	2.1E-09	n _{p m}		0	0	0	0
		k _{0 Au} (a)		0	0	0	0
		k _{0 Au} (m)		0	0	0	0
		${\sf G}_{\sf tha}$		0	0	0	0
		G _{e a}		0	0	0	0
5.1E+04	2.0E-09	G _{th m}		0	0	0	0
1.4E+05	2.1E-09	G _{e m}		0	0	0	0
2.6E-03	2.1E-09	f		0	0	0	0
1.3E+00) 2.1E-09	α		0	0	0	0
1.0E+00) 2.1E-09	Q _{0 a}		0	0	0	0

1.0E+00	2.1E-09	E _{ra}	0	0	0	0
1.0E+00	2.1E-09	Q _{0 m}	0	0	0	0
1.0E+00	2.1E-09	Erm	0	0	0	0
1.5E+01	2.1E-09	ϵ_{pm}^{eo} / ϵ_{pa}	0	0	0	0
-4.2E-02	2.1E-09	COI_m / COI_a	0	0	0	0
4.2E-01	2.1E-09	m _m	0	0	0	0
6.7E+03	2.1E-09	m _a	0	0	0	0
		W _m	0	0	0	0
1.9E+00	2.1E-09	υ	0	0	0	0
1.3E+02	2.1E-09					

3.4E-01	2.0E-09
8.4E-01	2.1E-09
8.4E-03	2.1E-09
2.4E-01	2.1E-09
4.6E-03	2.1E-09
9.8E+01	2.1E-09

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

			a ₁		a ₀	a ₋₁	a ₋₂
-5.2E-01	3.4E-01	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	3.5E-01	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	3.7E-01	a ₋₁		0.884	-0.957	1.000	-0.984
-3.4E-02	3.6E-01	a ₋₂		-0.804	0.896	-0.984	1.000
5.0E-04	3.5E-01	a ₋₃		0.748	-0.848	0.957	-0.993
1.2E+00	3.5E-01	E _{γm}		0	0	0	0
3.2E-01	3.5E-01	E _{γa}		0	0	0	0
-2.9E-01	3.5E-01	Δd_{a}		0	0	0	0
-2.9E-01	3.6E-01	Δd_{m}	ı	0	0	0	0
		δε _{r a}	3	0	0	0	0
		δε _{rr}	n	0	0	0	0

3.8E-02	3.5E-01
4.3E-02	3.5E-01

 x_i - $u(x_i)$ $y(x_i$ - $u(x_i))$

Correlation matrix of $\text{COI}_{\rm m}$ / $\text{COI}_{\rm a}$

			a_1	а	l ₀	a ₋₁	a_2
-5.2E-01	8.7E-01	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	8.7E-01	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	8.6E-01	a_1		0.884	-0.957	1.000	-0.984
-3.4E-02	8.6E-01	a ₋₂		-0.804	0.896	-0.984	1.000
5.0E-04	8.6E-01	a ₋₃		0.748	-0.848	0.957	-0.993
		$E_{\gamma 2\;m}$		0	() 0	0
		$a_{\gamma 2\ m}$		0	() 0	0
		$c_{\gamma 2 \ m}$		0	() 0	0
		$P/T_{\gamma 2 m}$		0	() 0	0

1.3E+03	8.6E-01
9.9E-01	8.6E-01
9.9E-01	8.6E-01
1.7E-01	8.4E-01

t _{d a}	t _{ca}	t _{la}	t _{d m}	t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0

		0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

a_3	$E_{\gamma m}$	$E_{\gamma a}$	$\Delta {\rm d}_{\rm a}$	$\Delta {\rm d}_{\rm m}$	$\delta\epsilon_{ra}$	δε _{r m}		Ci
0.748	3 0	() () (C	0	0	3.0E-01
-0.848	3 0	() C) (C	0	0	0.0E+00
0.957	0	() C) (C	0	0	-8.0E-01
-0.993	6 0	() C) (C	0	0	-3.2E+00
1.000) 0	() C) (C	0	0	-1.0E+01
() 1) C) (C	0	0	-2.5E-01
() 0	1	L C) (C	0	0	9.2E-01
() 0	() 1	L C	C	0	0	1.5E-02
() 0	() () 1	1	0	0	-1.7E-02
() 0	() C) (C	1	1	0.0E+00
() 0	() () (C	1	1	0.0E+00
Covariance

a ₋₃	$E_{\gamma 2 \ m}$	$a_{\gamma 2 m}$	$c_{\gamma 2 m}$	$P/T_{\gamma 2 m}$		Ci	
0.7	48	0	0	0	0	-1.9E-01	a_1
-0.8	348	0	0	0	0	-1.4E-01	a ₀
0.9	957	0	0	0	0	-1.1E-01	a_1
-0.9	93	0	0	0	0	-8.0E-02	a_2
1.0	000	0	0	0	0	-6.0E-02	a_3
	0	1	0	0	0	9.6E-05	$E_{\gamma 2} m$
	0	0	1	0	0	-1.4E-01	$a_{\gamma 2} m$
	0	0	0	1	0	-1.4E-01	$C_{\gamma 2} m$
	0	0	0	0	1	7.3E-01	$P/T_{\gamma 2 m}$

Ci

k _{0 Au} (m)	G_{tha}	G_{ea}	G_{thm}	G _{e m}	f	α	Q_{0a}	E _{ra}	
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0

0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Covariance matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

	a ₁	a ₀	a_1	a_2	a ₋₃	E _{γ m}	$E_{\gamma a}$
a ₁	1.9E-03	-2.4E-03	7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00
a ₀	-2.4E-03	3.2E-03	-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00
a_1	7.5E-04	-1.1E-03	3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00
a_2	-7.7E-05	1.1E-04	-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00
a ₋₃	2.4E-06	-3.6E-06	1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00
$E_{\gamma m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08	0.0E+00
$E_{\gamma a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08
$\Delta {\rm d_a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\Delta d_{\rm m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\delta\epsilon_{ra}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
δε _{r m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	3.0E-01	0.0E+00	-8.0E-01	-3.2E+00	-1.0E+01	-2.5E-01	9.2E-01

 $\mathbf{C}_{\mathbf{i}}$

matrix of COI_m/COI_a

a ₁	a ₀	a_1	a_2	a_3	$E_{\gamma 2} m$	$a_{\gamma 2 m}$	$C_{\gamma 2} m$	Ρ/Τ _{γ2 m}
1.9E-03	-2.4E-03	7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-2.4E-03	3.2E-03	-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
7.5E-04	-1.1E-03	3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-7.7E-05	1.1E-04	-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.4E-06	-3.6E-06	1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-02	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-04
-1.9E-01	-1.4E-01	-1.1E-01	-8.0E-02	-6.0E-02	9.6E-05	-1.4E-01	-1.4E-01	7.3E-01

Q _{0 m}	E _{rm}	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	° COI _m / CO	I _a m _m	m _a	w _m	
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

0	0	0	0	0	0	0
1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	1	0
0	0	0	0	0	0	1
0	0	0	0	0	0	0

Δd_a	Δd_m	δε _{r a}		δε _{r m}	
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
8.3E-02	0.0E+00		0.0E+00		0.0E+00
0.0E+00	8.3E-02		0.0E+00		0.0E+00
0.0E+00	0.0E+00		2.5E-05		2.8E-05
0.0E+00	0.0E+00		2.8E-05		3.1E-05
1.5E-02	-1.7E-02		0.0E+00		0.0E+00

Covariance matrix of ρ_{a}

	с _і		t _i	μ	
0	3.0E-16	t _i		3.0E+02	0.0E+00
0	-1.0E-10	μ		0.0E+00	2.5E-07
0	1.1E-16	t _{1/2 a}		0.0E+00	0.0E+00
0	-1.2E-17	t _{1/2 m}		0.0E+00	0.0E+00
0	6.1E-16	t _{d a}		0.0E+00	0.0E+00
0	3.6E-16	t _{c a}		0.0E+00	0.0E+00
0	-1.7E-15	t _{l a}		0.0E+00	0.0E+00
0	-8.7E-18	t _{d m}		0.0E+00	0.0E+00
0	-1.1E-13	t _{c m}		0.0E+00	0.0E+00
0	2.9E-12	t _{l m}		0.0E+00	0.0E+00
0	4.0E-14	n _{pa}		0.0E+00	0.0E+00
0	-1.5E-14	n _{p m}		0.0E+00	0.0E+00
0	-8.0E-07	k _{o Au} (a)		0.0E+00	0.0E+00
0	1.6E-09	k _{o Au} (m)		0.0E+00	0.0E+00
0	-2.0E-09	G_{tha}		0.0E+00	0.0E+00
0	-7.7E-11	G _{ea}		0.0E+00	0.0E+00
0	1.8E-09	G _{th m}		0.0E+00	0.0E+00
0	2.7E-10	G _{em}		0.0E+00	0.0E+00
0	-1.2E-11	f		0.0E+00	0.0E+00
0	-9.0E-10	CL		0.0E+00	0.0E+00
0	-1.8E-10	Q _{0 a}		0.0E+00	0.0E+00

0	-8.7E-17	E _{ra}	0.0E+00	0.0E+00
0	1.4E-10	Q _{0 m}	0.0E+00	0.0E+00
0	5.8E-14	Erm	0.0E+00	0.0E+00
0	6.0E-09	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	0.0E+00	0.0E+00
0	2.4E-09	COI _m / COI _a	0.0E+00	0.0E+00
0	2.5E-07	m _m	0.0E+00	0.0E+00
0	-8.7E-09	m _a	0.0E+00	0.0E+00
0	4.6E-07	W _m	0.0E+00	0.0E+00
1	-2.1E-11	υ	0.0E+00	0.0E+00

c_i 3.0E-16 -1.0E-10

t _{1/2 a}	t _{1/2 m}	t _{d a}	t _{ca}	t _{la}	t _{d m}	
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	4.3E+04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	6.7E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.2E+03	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E+03
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.1E-16	-1.2E-17	6.1E-16	3.6E-16	-1.7E-15	-8.7E-18

t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)	k _{o Au} (m)
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	2.2E+06	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	1.9E+05	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.7E-10	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-05
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.1E-13	2.9E-12	4.0E-14	-1.5E-14	-8.0E-07	1.6E-09

1	~		
(-		
	-	÷	2

G _{e a}	G _{th m}	G _{em}	f	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-01
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-2.0E-09	-7.7E-11	1.8E-09	2.7E-10	-1.2E-11

CL.	Q _{0 a}	E _{ra}	Q _{0 m}	E _{rm}	ε _{p m}	^{geo} / ε _{pa} geo
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	4.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	1.1E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	6.9E+05	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	3.6E-03	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.8E+01	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.6E-05
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-9.0E-10	-1.8E-10	-8.7E-17	1.4E-10	5.8E-14	6.0E-09

COI _m / COI _a	m _m		m _a	W _m	υ
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.9E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	2.5E-09	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	2.5E-09	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	2.1E-09	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E+00
2.4E-09	2.5E-07	-8.7E-09	4.6E-07	-2.1E-11

Irradiation and γ -spectrometry

end irradiation	9/12/2017	2.46 PM
irradiation time / s	21600	

library	CSF.Lib
calib	OR50_source2016_geom_cont_12052017.Clb
sm type	CSF.Lib (ROI32 Analysis)

Nuclide	Channel	Ene	ergy	Background
131Ba		1983.94	496.3	414907
Co60		4691.96	1173.2	5220
	target	pro	duct	
analite, a	¹³⁰ Ba	¹³¹ B	la	
monitor, m	⁵⁹ Co	⁶⁰ Co	C	

Uncertainty budget of ρ_{a}

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
t _i		S	21600
μ		1	0.0445
t _{1/2 a}		S	993600
	λ_{a}	s ⁻¹	7.0E-07
t _{1/2 m}		S	1.7E+08
	λ_{m}	s ⁻¹	4.2E-09
t _{d a}		S	2404405
t _{ca}		S	1292628
t _{la}		S	1264268
t _{d m}		S	3722775
t _{c m}		S	797
t _{l m}		S	740
	δ_{a}	1	1.022
	δ_{m}	1	1.077
	ξa	1	1.00098
	ξm	1	1.00319
n _{pa}		1	50777
n _{pm}		1	137487
k _{0 Au} (a)		1	0.00006480
k _{0 Au} (m)		1	1.3200
${\sf G}_{\sf tha}$		1	1

G _{e a}		1		1
G _{th m}		1		1
G _{e m}		1		1
f		1		15.60
α		1		-0.0360
Q _{0 a}		1		24.8
E _{ra}		eV		69.9
	Q _{0 a} (α)	1		28.85
Q _{0 m}		1		1.993
E _{rm}		eV		136.0
	Q _{0 m} (α)	1		2.319
$\epsilon_{pm}^{\ \ geo}$ / $\epsilon_{pa}^{\ \ geo}$		1		0.5033
$\text{COI}_{\text{m}} / \text{COI}_{\text{a}}$		1		0.981
m _m		g		0.00847
m _a		g		0.24000
w _m		g g⁻¹		0.004597
υ		mg L ⁻¹		99.2
Υ		[Y]	У	
$ ho_{a}$		g mL⁻¹		6.89E-08

Uncertainty budget of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
a ₁		Mev-1	-0.472
a ₀			1 -3.229
a ₋₁		Mev	0.403
a ₋₂		Mev2	-0.0320
a ₋₃		Mev3	0.000573
$E_{\gamma m}$		MeV	1.17320
$E_{\gamma a}$		MeV	0.49630
Δd_a		mm	0
$\Delta {\rm d}_{\rm m}$		mm	0
	e ₄	keV-4	-7.1E-11
	e ₃	keV-3	5.2E-08
	e ₂	keV-2	-1.4E-05
	e ₁	keV-1	1.8E-03
	e ₀		1 -4.5E-02
	d_1	keV-1	5.6E-06

d _o		1	4.2E-02
$\delta\epsilon_{ra}$	mm⁻¹		0.044
δε _{rm}	mm⁻¹		0.048
Y	[Y]	У	
$\epsilon_{pm}^{geo}/\epsilon_{pa}^{geo}$	1		0.503

Uncertainty budget of COI_{m} / COI_{a}

Input Quantity	Quantity	Unit	Valu	le
	X _i	[X _i]	x _i	
-				0.470
a ₁		Nev-1		-0.472
a ₀			1	-3.229
a ₋₁		Mev		0.403
a_2		Mev2		-0.0320
a_3		Mev3		0.000573
	b ₁		1	-0.571
	b ₀		1	1.079
	C ₂		1	-1.625
	C ₁		1	6.678
	c ₀		1	-7.006
$E_{\gamma 2 \ m}$		keV		1332.5
a _{γ2 m}			1	1.000
$C_{\gamma 2 m}$			1	1.000
Ρ/Τ _{γ2 m}			1	0.197
E _{γ29 a}		keV		123.80
a _{γ29 a}			1	1.000
$C_{\gamma 29 a}$			1	0.550
$P/T_{\gamma 29 a}$			1	0.712
	Y	[Y]	У	
	COI _m / COI _a		1	0.981

tart counting	source file	VHM	ert % FW	Unce	Cnts/s	3	Net area
10/10/2017	OR50_20171025_CSF_s	1.368	2.37	0.04	0.0	50777	
10/25/2017	OR50_20170925_Co_sa	1.798	0.32	5.919	185.9	137487	

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	$u_y^2(x_i)$		$x_i + u(x_i)$	y(x _i +u(x _i))
17	0.1%	2.4E-14	1.7E-25	0.0%	2.2E+04	6.9E-08
0.0005	1.1%	-3.4E-09	2.9E-24	0.0%	4.5E-02	6.9E-08
5184	0.5%	-7.4E-14	1.5E-19	0.2%	1.0E+06	6.8E-08
3.6E-09	0.5%					
2.6E+04	0.0%	-4.1E-16	1.1E-22	0.0%	1.7E+08	6.9E-08
6.5E-13	0.0%					
35	0.0%	4.8E-14	2.8E-24	0.0%	2.4E+06	6.9E-08
0.3	0.0%	2.3E-14	4.3E-29	0.0%	1.3E+06	6.9E-08
0.3	0.0%	-5.7E-14	2.7E-28	0.0%	1.3E+06	6.9E-08
35	0.0%	-2.9E-16	9.9E-29	0.0%	3.7E+06	6.9E-08
0.3	0.0%	-3.6E-12	1.1E-24	0.0%	8.0E+02	6.9E-08
0.3	0.0%	9.7E-11	7.8E-22	0.0%	7.4E+02	6.9E-08
0.000	0.0%					
0.001	0.1%					
0.00001	0.0%					
0.00004	0.0%					
1203	2.4%	1.4E-12	2.7E-18	2.9%	5.2E+04	7.1E-08
440	0.3%	-5.0E-13	4.9E-20	0.1%	1.4E+05	6.9E-08
0.00000013	0.2%	-1.1E-03	1.9E-20	0.0%	6.5E-05	6.9E-08
0.0053	0.4%	5.2E-08	7.6E-20	0.1%	1.3E+00	6.9E-08
0	0.0%	-2.4E-08	0.0E+00	0.0%	1.0E+00	6.9E-08

0	0.0%	-4.5E-08	0.0E+00	0.0%	1.0E+00	6.9E-08
0	0.0%	6.0E-08	0.0E+00	0.0%	1.0E+00	6.9E-08
0	0.0%	8.9E-09	0.0E+00	0.0%	1.0E+00	6.9E-08
0.33	2.1%	2.3E-09	5.6E-19	0.6%	1.6E+01	7.0E-08
0.0064	17.8%	1.5E-07	9.2E-19	1.0%	-3.0E-02	7.0E-08
5.0	20.0%	-1.8E-09	8.3E-17	89.3%	3.0E+01	6.1E-08
3.5	5.0%	-2.3E-11	6.3E-21	0.0%	7.3E+01	6.9E-08
5.83	20.2%					
0.060	3.0%	4.6E-09	7.5E-20	0.1%	2.1E+00	6.9E-08
6.9	5.1%	1.9E-12	1.7E-22	0.0%	1.4E+02	6.9E-08
0.095	4.1%					
0.0126	2.5%	1.4E-07	3.0E-18	3.2%	5.2E-01	7.1E-08
0.015	1.6%	7.0E-08	1.2E-18	1.3%	1.0E+00	7.0E-08
0.00005	0.6%	8.1E-06	1.7E-19	0.2%	8.5E-03	6.9E-08
0.00005	0.0%	-2.9E-07	2.1E-22	0.0%	2.4E-01	6.9E-08
0.000046	1.0%	1.5E-05	4.7E-19	0.5%	4.6E-03	7.0E-08
1.2	1.2%	-6.9E-10	6.9E-19	0.7%	1.0E+02	6.8E-08

u_c(y)

u_{cr}(y)

Σ

9.6E-09	14.0%	100.0%
J.0L 0J	14.070	100.070

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	c _i	u ² _y (x _i)		$x_i + u(x_i)$	$y(x_i+u(x_i))$
0.043	9.2%	3.4E-01	1.1E-04	70.0%	-4.3E-01	5.2E-01
0.057	1.8%	0.0E+00	0.0E+00	0.0%	-3.2E+00	5.0E-01
0.020	4.8%	-5.9E-01	-5.8E-05	-36.5%	4.2E-01	4.9E-01
0.0022	6.9%	-1.7E+00	1.5E-05	9.7%	-3.0E-02	5.0E-01
0.000075	13.1%	-3.8E+00	-1.0E-06	-0.6%	6.5E-04	5.0E-01
0.00012	0.0%	-3.7E-01	1.8E-09	0.0%	1.2E+00	5.0E-01
0.00012	0.0%	8.1E-01	8.8E-09	0.0%	5.0E-01	5.0E-01
0.29		2.2E-02	4.2E-05	26.4%	2.9E-01	5.1E-01
0.29		-2.4E-02	4.9E-05	31.0%	2.9E-01	5.0E-01
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					

	0.013	2.5%			100.0%		
u _c (y)	U _{c r}	u _{cr} (γ)		Σ			
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.4E-02	5.0E-01
	0.005	11.5%	0.0E+00	0.0E+00	0.0%	5.0E-02	5.0E-01
	0.0000	0.0%					

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	$u_y^2(x_i)$		$x_i + u(x_i)$	$y(x_i+u(x_i))$
0.043	9.2%	-0.2000	1.7E-05	7.1%	-4.3E-01	9.7E-01
0.057	1.8%	-0.0216	-1.9E-06	-0.8%	-3.2E+00	9.8E-01
0.020	4.8%	1.0307	-2.3E-05	-9.6%	4.2E-01	1.0E+00
0.0022	6.9%	9.2132	2.0E-05	8.3%	-3.0E-02	1.0E+00
0.000075	13.1%	74.6117	-5.0E-06	-2.1%	6.5E-04	9.9E-01
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0.1	0.0%	0.0001	1.6E-10	0.0%	1.3E+03	9.8E-01
0.012	1.2%	-0.1632	3.6E-06	1.5%	1.0E+00	9.8E-01
0.012	1.2%	-0.1632	3.6E-06	1.5%	1.0E+00	9.8E-01
0.023	11.5%	0.8402	2.8E-04	116.9%	2.2E-01	1.0E+00
0.12	0.1%	-0.0001	4.8E-11	0.0%	1.2E+02	9.8E-01
0.012	1.2%	0.1416	2.7E-06	1.1%	1.0E+00	9.8E-01
0.012	2.1%	0.2575	8.8E-06	3.7%	5.6E-01	9.8E-01
0.023	3.2%	-0.1991	-6.6E-05	-27.7%	7.4E-01	9.8E-01

u_c(y) u_r(y)

Σ

0.015 1.6%

100.0%

	t _c / s	t _I / s	t _{dead r} /	%	t _d / s	t _c / t _{1/2}	t _d / t ₁	L/2
10:39 AM	1292628	1264268		2.2%	2404405		1.30	2.4

10:39 AM	1292628	1264268	2.2%	2404405	1.30	2.4	
4:52 PM	797	740	7.2%	3722775	0.00	0.0	

Correlation matrix of ρ_{a}

$x_i - u(x_i)$	$y(x_i - u(x_i))$						
			t _i	μ	t _{1/2 a}	t _{1/2 m}	
2.2E+04	6.9E-08	t _i		1	0	0	0
4.4E-02	6.9E-08	μ		0	1	0	0
9.9E+05	6.9E-08	t _{1/2 a}		0	0	1	0
		t _{1/2 m}		0	0	0	1
1.7E+08	6.9E-08	t _{d a}		0	0	0	0
		t _{ca}		0	0	0	0
2.4E+06	6.9E-08	t _{la}		0	0	0	0
1.3E+06	6.9E-08	t _{d m}		0	0	0	0
1.3E+06	6.9E-08	t _{c m}		0	0	0	0
3.7E+06	6.9E-08	t _{l m}		0	0	0	0
8.0E+02	6.9E-08	n _{pa}		0	0	0	0
7.4E+02	6.9E-08	n _{p m}		0	0	0	0
		k _{0 Au} (a)		0	0	0	0
		k _{o Au} (m)		0	0	0	0
		G_{tha}		0	0	0	0
		G _{e a}		0	0	0	0
5.0E+04	6.7E-08	G _{th m}		0	0	0	0
1.4E+05	6.9E-08	G _{e m}		0	0	0	0
6.5E-05	6.9E-08	f		0	0	0	0
1.3E+00	6.9E-08	α		0	0	0	0
1.0E+00	6.9E-08	Q _{0 a}		0	0	0	0

1.0E+00	6.9E-08	E _{ra}	0	0	0	0
1.0E+00	6.9E-08	Q _{0 m}	0	0	0	0
1.0E+00	6.9E-08	Erm	0	0	0	0
1.5E+01	6.8E-08	$\epsilon_{pm}^{eo}/\epsilon_{pa}$	0	0	0	0
-4.2E-02	6.8E-08	COI_m / COI_a	0	0	0	0
2.0E+01	7.9E-08	m _m	0	0	0	0
6.6E+01	6.9E-08	m _a	0	0	0	0
		W _m	0	0	0	0
1.9E+00	6.9E-08	υ	0	0	0	0
1.3E+02	6.9E-08					

4.9E-01	6.7E-08
9.7E-01	6.8E-08
8.4E-03	6.8E-08
2.4E-01	6.9E-08
4.6E-03	6.8E-08
9.8E+01	7.0E-08

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

			a_1		a ₀	a ₋₁	a ₋₂
-5.2E-01	4.9E-01	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	5.0E-01	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	5.1E-01	a ₋₁		0.884	-0.957	1.000	-0.984
-3.4E-02	5.1E-01	a_2		-0.804	0.896	-0.984	1.000
5.0E-04	5.0E-01	a ₋₃		0.748	-0.848	0.957	-0.993
1.2E+00	5.0E-01	E _{γm}		0	0	0	0
5.0E-01	5.0E-01	E _{γa}		0	0	0	0
-2.9E-01	5.0E-01	Δd_a		0	0	0	0
-2.9E-01	5.1E-01	Δd_m		0	0	0	0
		$\delta\epsilon_{ra}$		0	0	0	0
		δε _{r m}		0	0	0	0

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of $\text{COI}_{\rm m}$ / $\text{COI}_{\rm a}$

			a ₁		a ₀	a ₋₁	a ₋₂
-5.2E-01	9.9E-01	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	9.8E-01	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	9.6E-01	a ₋₁		0.884	-0.957	1.000	-0.984
-3.4E-02	9.6E-01	a ₋₂		-0.804	0.896	-0.984	1.000
5.0E-04	9.8E-01	a ₋₃		0.748	-0.848	0.957	-0.993
		$E_{\gamma 2 \ m}$		0	0	0	0
		a _{γ2 m}		0	0	0	0
		$C_{\gamma 2 m}$		0	0	0	0
		Ρ/Τ _{γ2 m}	n	0	0	0	0
		Ε _{γ29 a}		0	0	0	0
1.3E+03	9.8E-01	a _{γ29 a}		0	0	0	0
9.9E-01	9.8E-01	$C_{\gamma 29 a}$		0	0	0	0
9.9E-01	9.8E-01	Ρ/Τ _{γ29}	а	0	0	0	0
1.7E-01	9.6E-01						
1.2E+02	9.8E-01						
9.9E-01	9.8E-01						

5.4E-01 9.8E-01 6.9E-01 9.9E-01

t _{d a}	t _{ca}	t _{la}	t _{d m}	t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0

-	Ũ	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

a_3	$E_{\gamma m}$	$E_{\gamma a}$	$\Delta {\rm d_a}$	$\Delta {\rm d}_{\rm m}$	$\delta\epsilon_{ra}$	δε _{r m}		Ci
0.748	3 ()	0	0	0	0	0	3.4E-01
-0.848	3 ()	0	0	0	0	0	0.0E+00
0.957	7 ()	0	0	0	0	0	-5.9E-01
-0.993	3 ()	0	0	0	0	0	-1.7E+00
1.000) ()	0	0	0	0	0	-3.8E+00
() 1	L	0	0	0	0	0	-3.7E-01
() ()	1	0	0	0	0	8.1E-01
() ()	0	1	0	0	0	2.2E-02
() ()	0	0	1	0	0	-2.4E-02
() ()	0	0	0	1	1	0.0E+00
() ()	0	0	0	1	1	0.0E+00

a ₋₃	$E_{\gamma 2 m}$	$a_{\gamma 2 m}$	$C_{\gamma 2 m}$	P/T _{γ2 m}	$E_{\gamma 29 a}$	$a_{\gamma 29 a}$	$C_{\gamma 29 a}$	P/T _{γ29 a}	
0.74	18	0	0	0	0	0	0	0	0
-0.84	18	0	0	0	0	0	0	0	0
0.95	57	0	0	0	0	0	0	0	0
-0.99	93	0	0	0	0	0	0	0	0
1.00	00	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	1
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0
	0	0	0	0	1	0	0	0	1
k _{0 Au} (m)	G_{tha}	G_{ea}	G_{thm}	G _{e m}	f	α	Q_{0a}	E _{ra}	
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	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0

0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Covariance matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

	a ₁	a ₀	a_1	a_2	a ₋₃	E _{γ m}	$E_{\gamma a}$
a ₁	1.9E-03	-2.4E-03	7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00
a ₀	-2.4E-03	3.2E-03	-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00
a ₋₁	7.5E-04	-1.1E-03	3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00
a_2	-7.7E-05	1.1E-04	-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00
a_3	2.4E-06	-3.6E-06	1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00
$E_{\gamma m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08	0.0E+00
$E_{\gamma a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08
$\Delta d_{\rm a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\Delta d_{\rm m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\delta\epsilon_{ra}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
δε _{r m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	3.4E-01	0.0E+00	-5.9E-01	-1.7E+00	-3.8E+00	-3.7E-01	8.1E-01

Ci

Covariance matrix of COI_m/COI_a

Ci		a ₁	a ₀	a_1
-2.0E-01	a ₁	1.9E-03	-2.4E-03	7.5E-04
-2.2E-02	a ₀	-2.4E-03	3.2E-03	-1.1E-03
1.0E+00	a_1	7.5E-04	-1.1E-03	3.8E-04
9.2E+00	a_2	-7.7E-05	1.1E-04	-4.3E-05
7.5E+01	a_3	2.4E-06	-3.6E-06	1.4E-06
1.1E-04	$E_{\gamma 2} m$	0.0E+00	0.0E+00	0.0E+00
-1.6E-01	$a_{\gamma 2} m$	0.0E+00	0.0E+00	0.0E+00
-1.6E-01	$C_{\gamma 2}$ m	0.0E+00	0.0E+00	0.0E+00
8.4E-01	$P/T_{\gamma 2 m}$	0.0E+00	0.0E+00	0.0E+00
-6.0E-05	$E_{\gamma 29 a}$	0.0E+00	0.0E+00	0.0E+00
1.4E-01	$a_{\gamma 29 a}$	0.0E+00	0.0E+00	0.0E+00
2.6E-01	$C_{\gamma 29 a}$	0.0E+00	0.0E+00	0.0E+00
-2.0E-01	$P/T_{\gamma 29 a}$	0.0E+00	0.0E+00	0.0E+00
	Ci	-2.0E-01	-2.2E-02	1.0E+00

Q _{0 m}	E _{rm}	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	° COI _m / CO	I _a m _m	m _a	w _m	
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

0	0	0	0	0	0	0
1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	1	0
0	0	0	0	0	0	1
0	0	0	0	0	0	0

Δd_a	Δd_m	δε _{r a}		δε _{r m}	
0.0E+00	0.0E+00		0.0E+00	(0.0E+00
0.0E+00	0.0E+00		0.0E+00	(0.0E+00
0.0E+00	0.0E+00		0.0E+00	(0.0E+00
0.0E+00	0.0E+00		0.0E+00	(0.0E+00
0.0E+00	0.0E+00		0.0E+00	(0.0E+00
0.0E+00	0.0E+00		0.0E+00	(0.0E+00
0.0E+00	0.0E+00		0.0E+00	(0.0E+00
8.3E-02	0.0E+00		0.0E+00	(0.0E+00
0.0E+00	8.3E-02		0.0E+00	(0.0E+00
0.0E+00	0.0E+00		2.6E-05		2.9E-05
0.0E+00	0.0E+00		2.9E-05		3.1E-05
2.2E-02	-2.4E-02		0.0E+00	(0.0E+00

a_2	a ₋₃	E _{γ2 m}	$a_{\gamma 2 m}$	C _{γ2 m}	Ρ/Τ _{γ2 m}	Ε _{γ29 a}
-7.7E-05	2.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.1E-04	-3.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-4.3E-05	1.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4.9E-06	-1.7E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.7E-07	5.7E-09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	1.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-04	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-02
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-04	0.0E+00
9.2E+00	7.5E+01	1.1E-04	-1.6E-01	-1.6E-01	8.4E-01	-6.0E-05

Covariance matrix of ρ_{a}

	Ci		ti	μ	
0	2.4E-14	t _i		3.0E+02	0.0E+00
0	-3.4E-09	μ		0.0E+00	2.5E-07
0	-7.4E-14	t _{1/2 a}		0.0E+00	0.0E+00
0	-4.1E-16	t _{1/2 m}		0.0E+00	0.0E+00
0	4.8E-14	t _{d a}		0.0E+00	0.0E+00
0	2.3E-14	t _{c a}		0.0E+00	0.0E+00
0	-5.7E-14	t _{l a}		0.0E+00	0.0E+00
0	-2.9E-16	t _{d m}		0.0E+00	0.0E+00
0	-3.6E-12	t _{c m}		0.0E+00	0.0E+00
0	9.7E-11	t _{l m}		0.0E+00	0.0E+00
0	1.4E-12	n _{pa}		0.0E+00	0.0E+00
0	-5.0E-13	n _{p m}		0.0E+00	0.0E+00
0	-1.1E-03	k _{o Au} (a)		0.0E+00	0.0E+00
0	5.2E-08	k _{o Au} (m)		0.0E+00	0.0E+00
0	-2.4E-08	G _{th a}		0.0E+00	0.0E+00
0	-4.5E-08	G _{e a}		0.0E+00	0.0E+00
0	6.0E-08	G _{th m}		0.0E+00	0.0E+00
0	8.9E-09	G _{e m}		0.0E+00	0.0E+00
0	2.3E-09	f		0.0E+00	0.0E+00
0	1.5E-07	CL.		0.0E+00	0.0E+00
0	-1.8E-09	Q _{0 a}		0.0E+00	0.0E+00

0	-2.3E-11	E _{ra}	0.0E+00	0.0E+00
0	4.6E-09	Q _{0 m}	0.0E+00	0.0E+00
0	1.9E-12	Erm	0.0E+00	0.0E+00
0	1.4E-07	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	0.0E+00	0.0E+00
0	7.0E-08	COI _m / COI _a	0.0E+00	0.0E+00
0	8.1E-06	m _m	0.0E+00	0.0E+00
0	-2.9E-07	m _a	0.0E+00	0.0E+00
0	1.5E-05	W _m	0.0E+00	0.0E+00
1	-6.9E-10	υ	0.0E+00	0.0E+00

c_i 2.4E-14 -3.4E-09

a _{γ29 a}		$C_{\gamma 29 a}$		Ρ/Τ _{γ29 a}
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	5.2E-04
	0.0E+00		0.0E+00	0.0E+00
	1.3E-04		0.0E+00	0.0E+00
	0.0E+00		1.3E-04	0.0E+00
	0.0E+00		0.0E+00	5.2E-04
	1.4E-01		2.6E-01	-2.0E-01

t _{1/2 a}	t _{1/2 m}	t _{d a}	t _{ca}	t _{la}	t _{d m}	
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	2.7E+07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	6.7E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.2E+03	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E+03
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-7.4E-14	-4.1E-16	4.8E-14	2.3E-14	-5.7E-14	-2.9E-16

t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)	k _{o Au} (m)
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.4E+06	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	1.9E+05	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.7E-14	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-05
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-3.6E-12	9.7E-11	1.4E-12	-5.0E-13	-1.1E-03	5.2E-08

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G _{e a}	G _{th m}	G _{em}	f	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-01
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-2.4E-08	-4.5E-08	6.0E-08	8.9E-09	2.3E-09

CL.	Q _{0 a}	E _{ra}	Q _{0 m}	E _{rm}	ε _{p m}	^{geo} / ε _{pa} geo
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	4.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	2.5E+01	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	1.2E+01	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	3.6E-03	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.8E+01	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-04
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.5E-07	-1.8E-09	-2.3E-11	4.6E-09	1.9E-12	1.4E-07

COI _m / COI _a	m _m		m _a	W _m	υ
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.4E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	2.5E-09	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	2.5E-09	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	2.1E-09	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E+00
7.0E-08	8.1E-06	-2.9E-07	1.5E-05	-6.9E-10

Irradiation and γ -spectrometry

end irradiation	9/12/2017	2.46 PM
irradiation time / s	21600	

library	CSF.Lib
calib	OR50_source2016_geom_cont_12052017.Clb
sm type	CSF.Lib (ROI32 Analysis)

Nuclide	Channel	E	nergy	Background
124Sb		6765.27	1691	9755
Co60		4691.96	1173.2	5220
	target	р	roduct	
analite, a	¹²³ Sb	12	²⁴ Sb	
monitor, m	⁵⁹ Co	60	°Co	

Uncertainty budget of ρ_{a}

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
t _i		S	21600
μ		1	0.0445
t _{1/2 a}		S	5201280
	λ_{a}	s ⁻¹	1.3E-07
t _{1/2 m}		S	1.7E+08
	λ_{m}	s ⁻¹	4.2E-09
t _{d a}		S	2404405
t _{ca}		S	1292628
t _{la}		S	1264268
t _{d m}		S	3722775
t _{c m}		S	797
t _{l m}		S	740
	δ_{a}	1	1.022
	δ_{m}	1	1.077
	ξa	1	1.00098
	ξm	1	1.00319
n _{pa}		1	2474
n _{pm}		1	137487
k _{o Au} (a)		1	0.01410
k _{0 Au} (m)		1	1.3200
${\sf G}_{\sf tha}$		1	1

G _{e a}		1		1
G _{th m}		1		1
G _{e m}		1		1
f		1		15.60
α		1		-0.0360
Q _{0 a}		1		28.8
E _{ra}		eV		28.2
	Q _{0 a} (α)	1		32.45
Q _{0 m}		1		1.993
E _{rm}		eV		136.0
	Q _{0 m} (α)	1		2.319
$\epsilon_{pm}^{\ \ geo}$ / $\epsilon_{pa}^{\ \ geo}$		1		1.4022
$\text{COI}_{\text{m}} / \text{COI}_{\text{a}}$		1		1.030
m _m		g		0.00847
m _a		g		0.24000
w _m		g g ⁻¹		0.004597
υ		$mg L^{-1}$		99.2
Υ		[Y]	У	
$ ho_{a}$		g mL⁻¹		4.01E-11

Uncertainty budget of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	X _i
a ₁		Mev-1	-0.472
a ₀			1 -3.229
a ₋₁		Mev	0.403
a_2		Mev2	-0.0320
a ₋₃		Mev3	0.000573
E _{γ m}		MeV	1.17320
$E_{\gamma a}$		MeV	1.69100
Δd_a		mm	0
Δd_{m}		mm	0
	e ₄	keV-4	-7.1E-11
	e ₃	keV-3	5.2E-08
	e ₂	keV-2	-1.4E-05
	e1	keV-1	1.8E-03
	e ₀		1 -4.5E-02
	d ₁	keV-1	5.6E-06

d ₀		1	4.2E-02
$\delta \epsilon_{ra}$	mm ⁻¹		0.051
δε _{rm}	mm ⁻¹		0.048
Y	[Y]	У	
$\varepsilon_{p m}^{geo} / \varepsilon_{p a}^{geo}$	1		1.402

Uncertainty budget of COI_{m} / COI_{a}

Input Quantity	Quantity	Unit	Va	lue
	X _i	[X _i]	x _i	
a ₁		Mev-1		-0.472
a ₀			1	-3.229
a ₋₁		Mev		0.403
a_2		Mev2		-0.0320
a_3		Mev3		0.000573
	b ₁		1	-0.571
	b ₀		1	1.079
	C ₂		1	-1.625
	C ₁		1	6.678
	c ₀		1	-7.006
Ε _{γ2 m}		keV		1332.5
a _{γ2 m}			1	1.000
$c_{\gamma 2 m}$			1	1.000
P/T _{γ2 m}			1	0.197
Ε _{γ12 a}		keV		1691.00
$P_{\gamma 12 a}$			1	47.60%
Ε _{γ24 a}		keV		602.70
a _{y24 a}			1	1.000
$c_{\gamma 24 a}$			1	1.000
$P/T_{\gamma 24 a}$			1	0.310
Ε _{γ13 a}		keV		1045.10
Р _{у13 а}			1	1.82%
Ε _{γ23 a}		keV		645.90
a _{γ23 a}			1	1.000
$C_{\gamma 23 a}$			1	1.000
Ε _{γ14 a}		keV		962.20
$P_{\gamma 14 a}$			1	1.88%
Ε _{γ22 a}		keV		722.80
a _{γ22 a}			1	0.890

$C_{\gamma 22 a}$			1	1.000
	Y	[Y]	У	
	COI _m / COI _a		1	1.030

Net area	Cnts/s	Uncert %	FWHM	source file	start counting
	2474 0.0	002 8.61	1.924	OR50_20171025_0	CSF_s: 10/10/2017
13	7487 185.9	0.32	1.798	OR50_20170925_(Co_sa 10/25/2017

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	$u_y^2(x_i)$		$x_i + u(x_i)$	$y(x_i+u(x_i))$
17	0.1%	2.6E-18	2.0E-33	0.0%	2.2E+04	4.0E-11
0.0005	1.1%	-2.0E-12	9.9E-31	0.0%	4.5E-02	4.0E-11
2592	0.0%	4.6E-18	1.4E-28	0.0%	5.2E+06	4.0E-11
6.6E-11	0.0%					
2.6E+04	0.0%	-2.4E-19	3.8E-29	0.0%	1.7E+08	4.0E-11
6.5E-13	0.0%					
35	0.0%	5.3E-18	3.4E-32	0.0%	2.4E+06	4.0E-11
0.3	0.0%	3.9E-18	1.3E-36	0.0%	1.3E+06	4.0E-11
0.3	0.0%	-3.3E-17	9.1E-35	0.0%	1.3E+06	4.0E-11
35	0.0%	-1.7E-19	3.4E-35	0.0%	3.7E+06	4.0E-11
0.3	0.0%	-2.1E-15	3.6E-31	0.0%	8.0E+02	4.0E-11
0.3	0.0%	5.6E-14	2.7E-28	0.0%	7.4E+02	4.0E-11
0.000	0.0%					
0.001	0.1%					
0.00001	0.0%					
0.00004	0.0%					
213	8.6%	1.6E-14	1.2E-23	77.6%	2.7E+03	4.4E-11
440	0.3%	-2.9E-16	1.6E-26	0.1%	1.4E+05	4.0E-11
0.00016	1.1%	-2.8E-09	1.9E-25	1.3%	1.4E-02	4.0E-11
0.0053	0.4%	3.0E-11	2.6E-26	0.2%	1.3E+00	4.0E-11
0	0.0%	-1.3E-11	0.0F+00	0.0%	1.0F+00	4 0F-11

0	0.0%	-2.7E-11	0.0E+00	0.0%	1.0E+00	4.0E-11
0	0.0%	3.5E-11	0.0E+00	0.0%	1.0E+00	4.0E-11
0	0.0%	5.2E-12	0.0E+00	0.0%	1.0E+00	4.0E-11
0.33	2.1%	1.4E-12	2.1E-25	1.4%	1.6E+01	4.1E-11
0.0064	17.8%	6.8E-11	1.9E-25	1.2%	-3.0E-02	4.1E-11
1.1	3.7%	-9.4E-13	1.0E-24	6.6%	3.0E+01	3.9E-11
1.8	6.4%	-3.4E-14	3.8E-27	0.0%	3.0E+01	4.0E-11
1.39	4.3%					
0.060	3.0%	2.7E-12	2.5E-26	0.2%	2.1E+00	4.0E-11
6.9	5.1%	1.1E-15	5.9E-29	0.0%	1.4E+02	4.0E-11
0.095	4.1%					
0.0387	2.8%	2.9E-11	1.2E-24	8.0%	1.4E+00	4.1E-11
0.008	0.8%	3.9E-11	9.2E-26	0.6%	1.0E+00	4.0E-11
0.00005	0.6%	4.7E-09	5.6E-26	0.4%	8.5E-03	4.0E-11
0.00005	0.0%	-1.7E-10	7.0E-29	0.0%	2.4E-01	4.0E-11
0.000046	1.0%	8.7E-09	1.6E-25	1.0%	4.6E-03	4.1E-11
1.2	1.2%	-4.0E-13	2.4E-25	1.5%	1.0E+02	4.0E-11

u_c(**y**) U_{c r}(**y**)

Σ

3.9E-12	9.8%	100.0%

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	c _i	u ² _y (x _i)		$x_i + u(x_i)$	$y(x_i+u(x_i))$
0.042	0.20/	7 25 04	0.25.04	FF 00/	4.25.04	4 45 00
0.043	9.2%	-7.3E-01	8.2E-04	55.0%	-4.3E-01	1.4E+00
0.057	1.8%	0.0E+00	0.0E+00	0.0%	-3.2E+00	1.4E+00
0.020	4.8%	3.7E-01	-1.6E-04	-10.4%	4.2E-01	1.4E+00
0.0022	6.9%	5.3E-01	2.3E-05	1.5%	-3.0E-02	1.4E+00
0.000075	13.1%	5.8E-01	-7.8E-07	-0.1%	6.5E-04	1.4E+00
0.00012	0.0%	-1.0E+00	1.4E-08	0.0%	1.2E+00	1.4E+00
0.00012	0.0%	8.4E-01	9.5E-09	0.0%	1.7E+00	1.4E+00
0.29		7.2E-02	4.3E-04	28.5%	2.9E-01	1.4E+00
0.29		-6.8E-02	3.8E-04	25.4%	2.9E-01	1.4E+00
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					

0.0000 0.0%

	0.039	2.8%			100.0%		
u _c (y)	U _{c r}	u _{cr} (y)		Σ			
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.4E-02	1.4E+00
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.7E-02	1.4E+00
	0.0000	0.0%					

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	$u_y^2(x_i)$		x _i +u(x _i)	$y(x_i+u(x_i))$
0.043	9.2%	-0.0990	1.5E-05	24.5%	-4.3E-01	1.0E+00
0.057	1.8%	0.0377	6.8E-06	11.2%	-3.2E+00	1.0E+00
0.020	4.8%	0.2171	-1.1E-05	-18.2%	4.2E-01	1.0E+00
0.0022	6.9%	0.4785	2.3E-06	3.9%	-3.0E-02	1.0E+00
0.000075	13.1%	0.8856	-1.3E-07	-0.2%	6.5E-04	1.0E+00
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0.1	0.0%	0.0001	1.8E-10	0.0%	1.3E+03	1.0E+00
0.012	1.2%	-0.1714	3.9E-06	6.5%	1.0E+00	1.0E+00
0.012	1.2%	-0.1714	3.9E-06	6.5%	1.0E+00	1.0E+00
0.023	11.5%	0.8823	-1.1E-04	-173.7%	2.2E-01	1.0E+00
0.12	0.0%	0.0000	1.6E-13	0.0%	1.7E+03	1.0E+00
0.12%	0.2%	0.0122	2.0E-10	0.0%	4.8E-01	1.0E+00
0.12	0.0%	-0.0003	1.0E-09	0.0%	6.0E+02	1.0E+00
0.012	1.2%	0.2148	6.2E-06	10.2%	1.0E+00	1.0E+00
0.012	1.2%	0.2148	6.2E-06	10.2%	1.0E+00	1.0E+00
0.036	11.5%	-0.7075	1.3E-04	219.2%	3.5E-01	1.0E+00
0.12	0.0%	0.0000	7.7E-14	0.0%	1.0E+03	1.0E+00
0.12%	6.3%	-0.1683	3.8E-08	0.1%	1.9E-02	1.0E+00
0.12	0.0%	0.0000	1.8E-13	0.0%	6.5E+02	1.0E+00
0.012	1.2%	-0.0031	1.3E-09	0.0%	1.0E+00	1.0E+00
0.012	1.2%	-0.0031	1.3E-09	0.0%	1.0E+00	1.0E+00
0.12	0.0%	0.0000	7.1E-14	0.0%	9.6E+02	1.0E+00
0.12%	6.1%	-0.1467	2.9E-08	0.0%	2.0E-02	1.0E+00
0.12	0.0%	0.0000	1.2E-13	0.0%	7.2E+02	1.0E+00
0.012	1.3%	-0.0031	1.3E-09	0.0%	9.0E-01	1.0E+00

	0.012	1.2%	-0.0028	1.0E-09	0.0%	1.0E+00	1.0E+00
u _c (y)	u _r (y)			Σ			

0.008 0.8% 100.0%

	t _c / s	t _I / s	t _{dead r} / %	t _d / s	t _c / t _{1/2}	t _d / t _{1/2}
10:39 AM	1292628	1264268	2.2%	2404405	0.25	0.5

10.39 AIVI	1292020	1204208	∠.∠/0	2404403	0.25	0
4:52 PM	797	740	7.2%	3722775	0.00	0.0

Correlation matrix of ρ_{a}

$x_i - u(x_i)$	$y(x_i - u(x_i))$						
			t _i	μ	t _{1/2 a}	t _{1/2 m}	
2.2E+04	4.0E-11	t _i		1	0	0	0
4.4E-02	4.0E-11	μ		0	1	0	0
5.2E+06	4.0E-11	t _{1/2 a}		0	0	1	0
		t _{1/2 m}		0	0	0	1
1.7E+08	4.0E-11	t _{d a}		0	0	0	0
		t _{ca}		0	0	0	0
2.4E+06	4.0E-11	t _{la}		0	0	0	0
1.3E+06	4.0E-11	t _{d m}		0	0	0	0
1.3E+06	4.0E-11	t _{c m}		0	0	0	0
3.7E+06	4.0E-11	t _{l m}		0	0	0	0
8.0E+02	4.0E-11	n _{p a}		0	0	0	0
7.4E+02	4.0E-11	n _{p m}		0	0	0	0
		k _{o Au} (a)		0	0	0	0
		k _{0 Au} (m)		0	0	0	0
		G_{tha}		0	0	0	0
		G _{e a}		0	0	0	0
2.3E+03	3.7E-11	G_{thm}		0	0	0	0
1.4E+05	4.0E-11	G _{e m}		0	0	0	0
1.4E-02	4.1E-11	f		0	0	0	0
1.3E+00	4.0E-11	α		0	0	0	0
1.0E+00	4.0E-11	Q_{0a}		0	0	0	0

1.0E+00	4.0E-11	E _{ra}	0	0	0	0
1.0E+00	4.0E-11	Q _{0 m}	0	0	0	0
1.0E+00	4.0E-11	Erm	0	0	0	0
1.5E+01	4.0E-11	ε_{pm}^{eo} / ε_{pa}	0	0	0	0
-4.2E-02	4.0E-11	COI_m / COI_a	0	0	0	0
2.8E+01	4.1E-11	m _m	0	0	0	0
2.6E+01	4.0E-11	m _a	0	0	0	0
		W _m	0	0	0	0
1.9E+00	4.0E-11	υ	0	0	0	0
1.3E+02	4.0E-11					
1.4E+00	3.9E-11					

1112.00	0.01 11
1.0E+00	4.0E-11
8.4E-03	4.0E-11
2.4E-01	4.0E-11
4.6E-03	4.0E-11
9.8E+01	4.1E-11

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

			a_1		a ₀	a ₋₁	a ₋₂
-5.2E-01	1.4E+00	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	1.4E+00	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	1.4E+00	a ₋₁		0.884	-0.957	1.000	-0.984
-3.4E-02	1.4E+00	a ₋₂		-0.804	0.896	-0.984	1.000
5.0E-04	1.4E+00	a ₋₃		0.748	-0.848	0.957	-0.993
1.2E+00	1.4E+00	$E_{\gamma m}$		0	0	0	0
1.7E+00	1.4E+00	E_{\gammaa}		0	0	0	0
-2.9E-01	1.4E+00	$\Delta {\rm d}_{\rm a}$		0	0	0	0
-2.9E-01	1.4E+00	$\Delta {\rm d}_{\rm m}$		0	0	0	0
		$\delta\epsilon_{\text{r}\text{a}}$		0	0	0	0
		$\delta\epsilon_{rm}$		0	0	0	0

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of COI_{m} / COI_{a}

			a_1		a ₀	a ₋₁	a_2	
-5.2E-01	1.0E+00	a ₁		1.000	-0.973	0.884	-0.8)4
-3.3E+00	1.0E+00	a ₀		-0.973	1.000) -0.957	0.89	96
3.8E-01	1.0E+00	a ₋₁		0.884	-0.957	1.000	-0.98	34
-3.4E-02	1.0E+00	a_2		-0.804	0.896	-0.984	1.00	00
5.0E-04	1.0E+00	a ₋₃		0.748	-0.848	0.957	-0.9	93
		$E_{\gamma 2 m}$		0	C) ()	0
		$a_{\gamma 2 m}$		0	C) ()	0
		$C_{\gamma 2\ m}$		0	C) ()	0
		$P/T_{\gamma 2 m}$		0	C) ()	0
		$E_{\gamma 12 a}$		0	C) ()	0
1.3E+03	1.0E+00	$P_{\gamma 12 a}$		0	C) ()	0
9.9E-01	1.0E+00	$E_{\gamma 24 a}$		0	C) ()	0
9.9E-01	1.0E+00	$a_{\gamma 24 a}$		0	C) ()	0
1.7E-01	1.0E+00	$C_{\gamma 24 a}$		0	C) ()	0
1.7E+03	1.0E+00	$P/T_{\gamma 24 a}$		0	C) ()	0
4.7E-01	1.0E+00	E _{γ13 a}		0	C) ()	0
6.0E+02	1.0E+00	$P_{\gamma 13 a}$		0	C) ()	0
9.9E-01	1.0E+00	$E_{\gamma 23 a}$		0	C) ()	0
9.9E-01	1.0E+00	$a_{\gamma 23 a}$		0	C) ()	0
2.7E-01	1.1E+00	$C_{\gamma 23 a}$		0	C) ()	0
1.0E+03	1.0E+00	$E_{\gamma 14 a}$		0	C) ()	0
1.7E-02	1.0E+00	$P_{\gamma 14 a}$		0	C) ()	0
6.5E+02	1.0E+00	$E_{\gamma 22 a}$		0	C) ()	0
9.9E-01	1.0E+00	$a_{\gamma 22 a}$		0	C) ()	0
9.9E-01	1.0E+00	$C_{\gamma 22 a}$		0	C) ()	0
9.6E+02	1.0E+00							
1.8E-02	1.0E+00							
7.2E+02	1.0E+00							
8.8E-01	1.0E+00							

9.9E-01 1.0E+00

t _{d a}	t _{ca}	t _{la}	t _{d m}	t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
		-	0	0	0	0	0	0	
---	---	---	---	---	---	---	---	---	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	

a ₋₃	$E_{\gamma m}$	$E_{\gamma a}$	Δd_{a}	Δd_{m}	$\delta\epsilon_{ra}$	δε _{r m}		Ci
0.74	8	0	0	0	0	0	0	-7.3E-01
-0.84	8	0	0	0	0	0	0	0.0E+00
0.95	7	0	0	0	0	0	0	3.7E-01
-0.99	3	0	0	0	0	0	0	5.3E-01
1.00	0	0	0	0	0	0	0	5.8E-01
	0	1	0	0	0	0	0	-1.0E+00
	0	0	1	0	0	0	0	8.4E-01
	0	0	0	1	0	0	0	7.2E-02
	0	0	0	0	1	0	0	-6.8E-02
	0	0	0	0	0	1	1	0.0E+00
	0	0	0	0	0	1	1	0.0E+00

a_3	$E_{\gamma 2 m}$	$a_{\gamma 2 m}$	$C_{\gamma 2 m}$	$P/T_{\gamma 2 m}$	Ε _{γ12 a}	$P_{\gamma 12 a}$	$E_{\gamma 24\;a}$	$a_{\gamma 24 a}$	
0	.748	0	0	0	0	0	0	0	0
-0	.848	0	0	0	0	0	0	0	0
0	.957	0	0	0	0	0	0	0	0
-0	.993	0	0	0	0	0	0	0	0
1	.000	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0

k _{0 Au} (m)	G_{tha}	G _{e a}	G _{th m}	G _{e m}	f	α	Q_{0a}	E _{ra}	Q _{0 m}	
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0	0
	0	0	0	0	1	0	0	0	0	0
	0	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	0	1	0	0

(0	0	0	0	0	0	0	0	1	0
(0	0	0	0	0	0	0	0	0	1
(0	0	0	0	0	0	0	0	0	0
(0	0	0	0	0	0	0	0	0	0
(0	0	0	0	0	0	0	0	0	0
(0	0	0	0	0	0	0	0	0	0
(0	0	0	0	0	0	0	0	0	0
(0	0	0	0	0	0	0	0	0	0
(0	0	0	0	0	0	0	0	0	0

Covariance matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

	a ₁	a ₀	a_1	a_2	a_3	E _{γ m}	$E_{\gamma a}$	Δd_{a}
a ₁	1.9E-03	-2.4E-03	7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00	0.0E+00
a ₀	-2.4E-03	3.2E-03	-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00	0.0E+00
a_1	7.5E-04	-1.1E-03	3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00	0.0E+00
a_2	-7.7E-05	1.1E-04	-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00	0.0E+00
a_3	2.4E-06	-3.6E-06	1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00	0.0E+00
$E_{\gamma m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08	0.0E+00	0.0E+00
$E_{\gamma a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08	0.0E+00
$\Delta {\rm d}_{\rm a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.3E-02
$\Delta d_{\rm m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\delta\epsilon_{ra}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
δε _{r m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	-7.3E-01	0.0E+00	3.7E-01	5.3E-01	5.8E-01	-1.0E+00	8.4E-01	7.2E-02

 $\mathbf{C}_{\mathbf{i}}$

С _{ү24 а}	$P/T_{\gamma 24 a}$	$E_{\gamma 13 a}$	Ρ _{γ13 a}	$E_{\gamma 23 a}$	$a_{\gamma 23 a}$	$C_{\gamma 23 a}$	Ε _{γ14 a}	$P_{\gamma 14 a}$	$E_{\gamma 22 a}$	
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0	0
	0	0	0	0	1	0	0	0	0	0
	0	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0

E _{r m}	$\epsilon_{pm}^{\ \ geo}$ / $\epsilon_{pa}^{\ \ geo}$	° COI _m / CO	l _a m _m	m _a	w _m	υ	
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

0	0	0	0	0	0	0
0	0	0	0	0	0	0
1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	1	0
0	0	0	0	0	0	1

Δd_m	δε _{ra}	δε	^e r m
0.0E+(00	0.0E+00	0.0E+00
0.0E+(00	0.0E+00	0.0E+00
0.0E+(00	0.0E+00	0.0E+00
0.0E+(00	0.0E+00	0.0E+00
0.0E+(00	0.0E+00	0.0E+00
0.0E+(00	0.0E+00	0.0E+00
0.0E+(00	0.0E+00	0.0E+00
0.0E+(00	0.0E+00	0.0E+00
8.3E-()2	0.0E+00	0.0E+00
0.0E+(00	3.5E-05	3.3E-05
0.0E+(00	3.3E-05	3.1E-05
-6.8E-0)2	0.0E+00	0.0E+00

Covariance matrix of COI_m/COI_a

a _{γ22 a}	$C_{\gamma 22 a}$		Ci		a ₁ a ₀	
	0	0	-9.9E-02	a ₁	1.9E-03	-2.4E-03
	0	0	3.8E-02	a ₀	-2.4E-03	3.2E-03
	0	0	2.2E-01	a ₋₁	7.5E-04	-1.1E-03
	0	0	4.8E-01	a_2	-7.7E-05	1.1E-04
	0	0	8.9E-01	a_3	2.4E-06	-3.6E-06
	0	0	1.2E-04	$E_{\gamma 2 m}$	0.0E+00	0.0E+00
	0	0	-1.7E-01	a _{γ2 m}	0.0E+00	0.0E+00
	0	0	-1.7E-01	$C_{\gamma 2} m$	0.0E+00	0.0E+00
	0	0	8.8E-01	Ρ/Τ _{γ2 m}	0.0E+00	0.0E+00
	0	0	-3.5E-06	$E_{\gamma 12}$ a	0.0E+00	0.0E+00
	0	0	1.2E-02	$P_{\gamma 12 a}$	0.0E+00	0.0E+00
	0	0	-2.8E-04	$E_{\gamma 24}$ a	0.0E+00	0.0E+00
	0	0	2.1E-01	$a_{\gamma 24 a}$	0.0E+00	0.0E+00
	0	0	2.1E-01	$C_{\gamma 24 a}$	0.0E+00	0.0E+00
	0	0	-7.1E-01	$P/T_{\gamma 24 a}$	0.0E+00	0.0E+00
	0	0	2.4E-06	$E_{\gamma 13 a}$	0.0E+00	0.0E+00
	0	0	-1.7E-01	$P_{\gamma 13 a}$	0.0E+00	0.0E+00
	0	0	3.7E-06	Ε _{γ23 a}	0.0E+00	0.0E+00
	0	0	-3.1E-03	a _{γ23 a}	0.0E+00	0.0E+00
	0	0	-3.1E-03	$C_{\gamma 23 a}$	0.0E+00	0.0E+00
	0	0	2.3E-06	E _{γ14 a}	0.0E+00	0.0E+00
	0	0	-1.5E-01	$P_{\gamma 14 a}$	0.0E+00	0.0E+00
	0	0	3.0E-06	Ε _{γ22 a}	0.0E+00	0.0E+00
	1	0	-3.1E-03	a _{γ22 a}	0.0E+00	0.0E+00
	0	1	-2.8E-03	С _{722 а}	0.0E+00	0.0E+00
				Ci	-9.9E-02	3.8E-02

Covariance matrix of ρ_{a}

Ci			t _i	μ	t _{1/2 a}	t _{1/2 m}	t _{d a}	t _{ca}
	2.6E-18	t _i	3.0E+02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	-2.0E-12	μ	0.0E+00	2.5E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	4.6E-18	t _{1/2 a}	0.0E+00	0.0E+00	6.7E+06	0.0E+00	0.0E+00	0.0E+00
	-2.4E-19	t _{1/2 m}	0.0E+00	0.0E+00	0.0E+00	6.7E+08	0.0E+00	0.0E+00
	5.3E-18	t _{d a}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E+03	0.0E+00
	3.9E-18	t _{ca}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.3E-02
	-3.3E-17	t _{la}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	-1.7E-19	t _{d m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	-2.1E-15	t _{c m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	5.6E-14	t _{l m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	1.6E-14	n _{pa}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	-2.9E-16	n _{p m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	-2.8E-09	k _{o Au} (a)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	3.0E-11	k _{o Au} (m)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	-1.3E-11	G _{th a}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	-2.7E-11	G _{e a}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	3.5E-11	G _{th m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	5.2E-12	G _{e m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	1.4E-12	f	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	6.8E-11	CL	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	-9.4E-13	Q _{0a}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

-3.4E-14	E _{ra}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.7E-12	Q _{0 m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.1E-15	E _{rm}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.9E-11	$\epsilon_{pm}^{\ \ geo}$ / $\epsilon_{pa}^{\ \ geo}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3.9E-11	COI_m / COI_a	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4.7E-09	m _m	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.7E-10	m _a	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
8.7E-09	W _m	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-4.0E-13	υ	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Ci	2.6E-18	-2.0E-12	4.6E-18	-2.4E-19	5.3E-18	3.9E-18

a_1	a_2	a_3	E _{γ2 m}	a _{γ2 m}	C _{γ2 m}	$P/T_{\gamma 2 m}$	$E_{\gamma 12 a}$	$P_{\gamma 12 a}$
7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	1.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-04	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-02	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-06
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.1E-04	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.2E-01	4.8E-01	8.9E-01	1.2E-04	-1.7E-01	-1.7E-01	8.8E-01	-3.5E-06	1.2E-02

+	+	+	+	5	12	k (a)	(ma)	C	C
L _{I a}	L _{d m}	L _{c m}	ι _{l m}	n _{p a}	n _{p m}	к _{о Au} (а)	K _{0 Au} (m)	G _{th a}	G _{ea}
0.0E+00	0.0E+00	0.0E+00	0.0E+00						
0.0E+00	0.0E+00	0.0E+00	0.0E+00						
0.0E+00	0.0E+00	0.0E+00	0.0E+00						
0.0E+00	0.0E+00	0.0E+00	0.0E+00						
0.0E+00	0.0E+00	0.0E+00	0.0E+00						
0.0E+00	0.0E+00	0.0E+00	0.0E+00						
8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	1.2E+03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.5E+04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E+05	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E-08	0.0E+00	0.0E+00	0.0E+00
0.0E+00	2.8E-05	0.0E+00	0.0E+00						
0.0E+00	0.0E+00	0.0E+00	0.0E+00						
0.0E+00	0.0E+00	0.0E+00	0.0E+00						
0.0E+00	0.0E+00	0.0E+00	0.0E+00						
0.0E+00	0.0E+00	0.0E+00	0.0E+00						
0.0E+00	0.0E+00	0.0E+00	0.0E+00						
0.0E+00	0.0E+00	0.0E+00	0.0E+00						
0.0E+00	0.0E+00	0.0E+00	0.0E+00						

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-3.3E-17	-1.7E-19	-2.1E-15	5.6E-14	1.6E-14	-2.9E-16	-2.8E-09	3.0E-11	-1.3E-11	-2.7E-11

E _{γ24 a}	$a_{\gamma 24 a}$	$C_{\gamma 24 a}$	$P/T_{\gamma 24 a}$	$E_{\gamma 13 a}$	P _{γ13 a}	$E_{\gamma 23 a}$	$a_{\gamma 23 a}$	$C_{\gamma 23 a}$	$E_{\gamma 14 a}$
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	8.1E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	1.3E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	1.3E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-02	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-02
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-2.8E-04	2.1E-01	2.1E-01	-7.1E-01	2.4E-06	-1.7E-01	3.7E-06	-3.1E-03	-3.1E-03	2.3E-06

G _{th m}	G _{em} f		Cl.	Q _{0 a}	E _{ra}	Q _{0 m}	E _{rm}	$\varepsilon_{pm} / \varepsilon_{pa}$
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	1.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	4.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.3E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E-03	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.8E+01	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-03
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3.5E-11	5.2E-12	1.4E-12	6.8E-11	-9.4E-13	-3.4E-14	2.7E-12	1.1E-15	2.9E-11

P _{γ14} a	$E_{\gamma 22 a}$	$a_{\gamma 22} a$	$C_{\gamma 22}$ a
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.3E-06	0.0E+00	0.0E+00	0.0E+00
0.0E+00	1.3E-02	0.0E+00	0.0E+00
0.0E+00	0.0E+00	1.3E-04	0.0E+00
0.0E+00	0.0E+00	0.0E+00	1.3E-04

-1.5E-01 3.0E-06 -3.1E-03 -2.8E-03

COI _m / COI _a	m _m	m _a	W _m	υ
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 6.1E-05 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.5E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.5E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 6.1E-05 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.5E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.5E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 6.1E-05 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.5E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.5E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.5E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 1.4E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
6.1E-05 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.5E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.5E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 1.4E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00 2.5E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.5E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.1E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 1.4E+00	6.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00 0.0E+00 2.5E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.1E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 1.4E+00	0.0E+00	2.5E-09	0.0E+00	0.0E+00	0.0E+00
0.0E+00 0.0E+00 0.0E+00 2.1E-09 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 1.4E+00	0.0E+00	0.0E+00	2.5E-09	0.0E+00	0.0E+00
0.0E+00 0.0E+00 0.0E+00 1.4E+0	0.0E+00	0.0E+00	0.0E+00	2.1E-09	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E+00

3.9E-11 4.7E-09 -1.7E-10 8.7E-09 -4.0E-13

Irradiation and γ -spectrometry

end irradiation	9/12/2017	2.46 PM
irradiation time / s	21600	

library	CSF.Lib
calib	OR50_source2016_geom_cont_12052017.Clb
sm type	CSF.Lib (ROI32 Analysis)

Nuclide	Channel	E	inergy	Background
46Sc		3555.94	889.3	98862
Co60		4691.96	1173.2	5220
	target	þ	product	
analite, a	⁴⁵ Sc	4	⁶ Sc	
monitor, m	⁵⁹ Co	6	°Co	

Uncertainty budget of ρ_{a}

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
t _i		S	21600
μ		1	0.0445
t _{1/2 a}		S	7242912
	λ_{a}	s ⁻¹	9.6E-08
t _{1/2 m}		S	1.7E+08
	λ_{m}	s ⁻¹	4.2E-09
t _{d a}		S	2404405
t _{ca}		S	1292628
t _{la}		S	1264268
t _{d m}		S	3722775
t _{c m}		S	797
t _{l m}		S	740
	δ_{a}	1	1.022
	δ_{m}	1	1.077
	ξa	1	1.00098
	ξm	1	1.00319
n _{pa}		1	130702
n _{pm}		1	137487
k _{o Au} (a)		1	1.2200
k _{0 Au} (m)		1	1.3200
G _{th a}		1	1

G _{e a}		1		1
G _{th m}		1		1
G _{e m}		1		1
f		1		15.60
α		1		-0.0360
Q _{0 a}		1		0.430
E _{ra}		eV		5130
	$Q_{0a}(\alpha)$	1		0.45
Q _{0 m}		1		1.993
E _{r m}		eV		136.0
	Q _{0 m} (α)	1		2.319
ϵ_{pm}^{geo} / ϵ_{pa}^{geo}		1		0.7968
COI_m / COI_a		1		1.009
m _m		g		0.00847
m _a		g		0.24000
W _m		g g⁻¹		0.004597
υ		${\sf mg} {\sf L}^{-1}$		99.2
Y		[Y]	У	
$ ho_a$		g mL ⁻¹		5.06E-11

Uncertainty budget of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
a ₁		Mev-1	-0.472
a ₀			1 -3.229
a ₋₁		Mev	0.403
a_2		Mev2	-0.0320
a ₋₃		Mev3	0.000573
$E_{\gamma m}$		MeV	1.17320
$E_{\gamma a}$		MeV	0.88930
Δd_a		mm	0
$\Delta {\rm d}_{\rm m}$		mm	0
	e ₄	keV-4	-7.1E-11
	e ₃	keV-3	5.2E-08
	e ₂	keV-2	-1.4E-05
	e ₁	keV-1	1.8E-03
	e ₀		1 -4.5E-02
	d_1	keV-1	5.6E-06

d _o		1	4.2E-02
$\delta \epsilon_{ra}$	mm ⁻¹		0.047
$\delta\epsilon_{rm}$	mm ⁻¹		0.048
Y	[Y]	у	
$\epsilon_{p m}^{geo} / \epsilon_{p a}^{geo}$	1		0.797

Uncertainty budget of COI_{m} / COI_{a}

Input Quantity	Quantity	Unit	Val	ue
	X _i	[X _i]	x _i	
a ₁		Mev-1		-0.472
a ₀			1	-3.229
a_1		Mev		0.403
a_2		Mev2		-0.0320
a_3		Mev3		0.000573
	b ₁		1	-0.571
	b ₀		1	1.079
	C ₂		1	-1.625
	c ₁		1	6.678
	C ₀		1	-7.006
E _{γ2 m}		keV		1332.5
a _{γ2 m}			1	1.000
$C_{\gamma 2 m}$			1	1.000
Ρ/Τ _{γ2 m}			1	0.197
$E_{\gamma 1 a}$		keV		1120.5
$P_{\gamma 1 a}$			1	99.99%
$P/T_{\gamma 1 a}$			1	0.217
a _{γ2 a}			1	1.000
C _{γ2 a}			1	1.000
$P_{\gamma 2 a}$			1	99.98%
	Y	[Y]	У	
	COI _m / COI _a		1	1.009

tart counting	source file	WHM	ert % FW	Unc	Cnts/s	Net area
10/10/2017	OR50_20171025_CSF_s	1.615	0.61	0.103	0.1	130702
10/25/2017	OR50_20170925_Co_sa	1.798	0.32	85.919	87 185.9	137487

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	u ² _y (x _i)		$x_i + u(x_i)$	$y(x_i+u(x_i))$
17	0.1%	2.3E-18	1.6E-33	0.0%	2.2E+04	5.1E-11
0.0005	1.1%	-2.5E-12	1.6E-30	0.0%	4.5E-02	5.1E-11
1728	0.0%	5.0E-18	7.3E-29	0.0%	7.2E+06	5.1E-11
2.3E-11	0.0%					
2.6E+04	0.0%	-3.0E-19	6.0E-29	0.0%	1.7E+08	5.1E-11
6.5E-13	0.0%					
35	0.0%	4.8E-18	2.8E-32	0.0%	2.4E+06	5.1E-11
0.3	0.0%	4.1E-18	1.4E-36	0.0%	1.3E+06	5.1E-11
0.3	0.0%	-4.2E-17	1.5E-34	0.0%	1.3E+06	5.1E-11
35	0.0%	-2.1E-19	5.3E-35	0.0%	3.7E+06	5.1E-11
0.3	0.0%	-2.6E-15	5.7E-31	0.0%	8.0E+02	5.1E-11
0.3	0.0%	7.1E-14	4.2E-28	0.0%	7.4E+02	5.1E-11
0.000	0.0%					
0.001	0.1%					
0.00001	0.0%					
0.00004	0.0%					
797	0.6%	3.9E-16	9.5E-26	4.1%	1.3E+05	5.1E-11
440	0.3%	-3.7E-16	2.6E-26	1.1%	1.4E+05	5.0E-11
0.0049	0.4%	-4.2E-11	4.1E-26	1.7%	1.2E+00	5.0E-11
0.0053	0.4%	3.8E-11	4.1E-26	1.7%	1.3E+00	5.1E-11
0	0.0%	-4.9E-11	0.0E+00	0.0%	1.0E+00	5.1E-11

0	0.0%	-1.4E-12	0.0E+00	0.0%	1.0E+00	5.1E-11
0	0.0%	4.4E-11	0.0E+00	0.0%	1.0E+00	5.1E-11
0	0.0%	6.6E-12	0.0E+00	0.0%	1.0E+00	5.1E-11
0.33	2.1%	-3.3E-13	1.2E-26	0.5%	1.6E+01	5.1E-11
0.0064	17.8%	-2.6E-11	2.7E-26	1.2%	-3.0E-02	5.0E-11
0.086	20.0%	-4.3E-12	1.4E-25	5.8%	5.2E-01	5.0E-11
872	17.0%	-3.0E-20	7.0E-34	0.0%	6.0E+03	5.1E-11
0.12	25.8%					
0.060	3.0%	3.4E-12	4.1E-26	1.7%	2.1E+00	5.1E-11
6.9	5.1%	1.4E-15	9.4E-29	0.0%	1.4E+02	5.1E-11
0.095	4.1%					
0.0169	2.1%	6.4E-11	1.2E-24	49.3%	8.1E-01	5.2E-11
0.004	0.4%	5.0E-11	4.8E-26	2.0%	1.0E+00	5.1E-11
0.00005	0.6%	6.0E-09	8.9E-26	3.8%	8.5E-03	5.1E-11
0.00005	0.0%	-2.1E-10	1.1E-28	0.0%	2.4E-01	5.1E-11
0.000046	1.0%	1.1E-08	2.6E-25	10.9%	4.6E-03	5.1E-11
1.2	1.2%	-5.1E-13	3.8E-25	16.0%	1.0E+02	5.0E-11

u_c(y)

u_{cr}(y)

Σ

1.5E-12	3.0%	100.0%
1.5E-12	3.0%	100.0%

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	c _i	u ² _y (x _i)		$x_i + u(x_i)$	y(x _i +u(x _i))
0.042	0.20/	2 25 01		22 40/		0 1 5 0 1
0.043	9.2%	2.3E-01	6.7E-05	23.4%	-4.3E-U1	8.1E-U1
0.057	1.8%	0.0E+00	0.0E+00	0.0%	-3.2E+00	8.0E-01
0.020	4.8%	-2.2E-01	-2.3E-05	-7.9%	4.2E-01	7.9E-01
0.0022	6.9%	-4.3E-01	4.4E-06	1.5%	-3.0E-02	8.0E-01
0.000075	13.1%	-6.4E-01	-2.0E-07	-0.1%	6.5E-04	8.0E-01
0.00012	0.0%	-5.8E-01	4.5E-09	0.0%	1.2E+00	8.0E-01
0.00012	0.0%	7.1E-01	6.8E-09	0.0%	8.9E-01	8.0E-01
0.29		3.7E-02	1.2E-04	40.2%	2.9E-01	8.1E-01
0.29		-3.8E-02	1.2E-04	42.9%	2.9E-01	7.9E-01
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					

0.000 0.0%

	0.0000	0.0%					
	0.005	11.5%	0.0E+00	0.0E+00	0.0%	5.2E-02	8.0E-01
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.4E-02	8.0E-01
u _c (y)	γ) μ _{c r} (γ)		Σ				
	0.017	2.1%			100.0%		

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	$u_y^2(x_i)$		$x_i + u(x_i)$	$y(x_i+u(x_i))$
0.043	9.2%	-0.0240	1.2E-06	6.2%	-4.3E-01	1.0E+00
0.057	1.8%	0.0104	6.4E-07	3.3%	-3.2E+00	1.0E+00
0.020	4.8%	0.0331	-6.1E-07	-3.2%	4.2E-01	1.0E+00
0.0022	6.9%	0.0474	8.8E-08	0.5%	-3.0E-02	1.0E+00
0.000075	13.1%	0.0557	-3.2E-09	0.0%	6.5E-04	1.0E+00
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0.1	0.0%	0.0001	1.7E-10	0.0%	1.3E+03	1.0E+00
0.012	1.2%	-0.1678	3.8E-06	19.7%	1.0E+00	1.0E+00
0.012	1.2%	-0.1678	3.8E-06	19.7%	1.0E+00	1.0E+00
0.023	11.5%	0.8639	-2.6E-05	-136.3%	2.2E-01	1.0E+00
0.12	0.0%	-0.0001	2.4E-10	0.0%	1.1E+03	1.0E+00
0.01%	0.0%	0.1782	4.2E-10	0.0%	1.0E+00	1.0E+00
0.025	11.5%	-0.8352	2.8E-05	145.4%	2.4E-01	9.9E-01
0.012	1.2%	0.1782	4.2E-06	22.2%	1.0E+00	1.0E+00
0.012	1.2%	0.1782	4.2E-06	22.2%	1.0E+00	1.0E+00
0.12%	0.1%	-0.1782	4.2E-08	0.2%	1.0E+00	1.0E+00

u_c(γ) u_r(γ)

Σ

0.004 0.4%

100.0%

	t _c / s	t _I / s	t _{dead r} / %	t _d / s	t _c / t ₁	/2 t _d /	′ t _{1/2}
10:39 AM	1292628	1264268	2.2%	6 24044	105	0.18	0.3

10.59 AIVI	1292020	1204200	Z.Z70	2404405	0.10	0.5
4:52 PM	797	740	7.2%	3722775	0.00	0.0

Correlation matrix of ρ_{a}

$x_i - u(x_i)$	$y(x_i - u(x_i))$						
			t _i	μ	t _{1/2 a}	t _{1/2 m}	
2.2E+04	5.1E-11	t _i		1	0	0	0
4.4E-02	5.1E-11	μ		0	1	0	0
7.2E+06	5.1E-11	t _{1/2 a}		0	0	1	0
		t _{1/2 m}		0	0	0	1
1.7E+08	5.1E-11	t _{d a}		0	0	0	0
		t _{ca}		0	0	0	0
2.4E+06	5.1E-11	t _{la}		0	0	0	0
1.3E+06	5.1E-11	t _{d m}		0	0	0	0
1.3E+06	5.1E-11	t _{c m}		0	0	0	0
3.7E+06	5.1E-11	t _{i m}		0	0	0	0
8.0E+02	5.1E-11	n _{p a}		0	0	0	0
7.4E+02	5.1E-11	n _{p m}		0	0	0	0
		k _{0 Au} (a)		0	0	0	0
		k _{0 Au} (m)		0	0	0	0
		G_{tha}		0	0	0	0
		G _{e a}		0	0	0	0
1.3E+05	5.0E-11	G _{th m}		0	0	0	0
1.4E+05	5.1E-11	G _{e m}		0	0	0	0
1.2E+00	5.1E-11	f		0	0	0	0
1.3E+00	5.0E-11	α		0	0	0	0
1.0E+00	5.1E-11	Q _{0 a}		0	0	0	0

1.0E+00	5.1E-11	E _{ra}	0	0	0	0
1.0E+00	5.1E-11	Q _{0 m}	0	0	0	0
1.0E+00	5.1E-11	Erm	0	0	0	0
1.5E+01	5.1E-11	$\varepsilon_{pm}^{eo}/\varepsilon_{pa}$	0	0	0	0
-4.2E-02	5.1E-11	COI_m / COI_a	0	0	0	0
3.4E-01	5.1E-11	m _m	0	0	0	0
4.3E+03	5.1E-11	m _a	0	0	0	0
		W _m	0	0	0	0
1.9E+00	5.0E-11	υ	0	0	0	0
1.3E+02	5.1E-11					
7.8E-01	5.0E-11					

1.0E+00	5.0E-11
8.4E-03	5.0E-11
2.4E-01	5.1E-11
4.6E-03	5.0E-11
9.8E+01	5.1E-11

 x_i - $u(x_i)$ $y(x_i$ - $u(x_i))$

Correlation matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

			a ₁		a ₀	a ₋₁	a ₋₂
-5.2E-01	7.9E-01	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	8.0E-01	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	8.0E-01	a ₋₁		0.884	-0.957	1.000	-0.984
-3.4E-02	8.0E-01	a ₋₂		-0.804	0.896	-0.984	1.000
5.0E-04	8.0E-01	a ₋₃		0.748	-0.848	0.957	-0.993
1.2E+00	8.0E-01	Eγm	ı	0	0	0	0
8.9E-01	8.0E-01	E _{γ a}		0	0	0	0
-2.9E-01	7.9E-01	Δd_{a}	3	0	0	0	0
-2.9E-01	8.1E-01	Δd_r	n	0	0	0	0
		δε _r	а	0	0	0	0
		$\delta\epsilon_r$	m	0	0	0	0

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of $\text{COI}_{\rm m}$ / $\text{COI}_{\rm a}$

			a_1		a ₀	a ₋₁	a_2
-5.2E-01	1.0E+00	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	1.0E+00	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	1.0E+00	a_1		0.884	-0.957	1.000	-0.984
-3.4E-02	1.0E+00	a ₋₂		-0.804	0.896	-0.984	1.000
5.0E-04	1.0E+00	a ₋₃		0.748	-0.848	0.957	-0.993
		$E_{\gamma 2\ m}$		0	0	0	0
		$a_{\gamma 2\ m}$		0	0	0	0
		$C_{\gamma 2 \ m}$		0	0	0	0
		$P/T_{\gamma 2 m}$		0	0	0	0
		$E_{\gamma 1 \text{ a}}$		0	0	0	0
1.3E+03	1.0E+00	$P_{\gamma 1 a}$		0	0	0	0
9.9E-01	1.0E+00	$P/T_{\gamma 1 a}$		0	0	0	0
9.9E-01	1.0E+00	$a_{\gamma 2 a}$		0	0	0	0
1.7E-01	9.9E-01	$C_{\gamma 2 a}$		0	0	0	0
1.1E+03	1.0E+00	$P_{\gamma 2 a}$		0	0	0	0
1.0E+00	1.0E+00						
1.9E-01	1.0E+00						
9.9E-01	1.0E+00						

9.9E-01 1.0E+00

1.0E+00 1.0E+00

t _{d a}	t _{ca}	t _{la}	t _{d m}	t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0

-	Ũ	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

a_3	$E_{\gamma m}$	$E_{\gamma a}$	$\Delta {\rm d_a}$	$\Delta {\rm d}_{\rm m}$	$\delta\epsilon_{ra}$	δε _{r m}		Ci	
0.748	3	0	0	0	0	0	0	2.3E-01	
-0.848	3	0	0	0	0	0	0	0.0E+00	
0.95	7	0	0	0	0	0	0	-2.2E-01	
-0.993	3	0	0	0	0	0	0	-4.3E-01	
1.000)	0	0	0	0	0	0	-6.4E-01	
()	1	0	0	0	0	0	-5.8E-01	
()	0	1	0	0	0	0	7.1E-01	
()	0	0	1	0	0	0	3.7E-02	
()	0	0	0	1	0	0	-3.8E-02	
()	0	0	0	0	1	1	0.0E+00	
()	0	0	0	0	1	1	0.0E+00	
a ₋₃	$E_{\gamma 2 m}$	a _{γ2 m}	$C_{\gamma 2 m}$	Ρ/Τ _{γ2 m}	$E_{\gamma 1 a}$	$P_{\gamma 1 a}$	Ρ/Τ _{γ1 a}	$a_{\gamma 2 a}$	
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0.748	0) (0 (0	0	0	0	0	0
-0.848	0) (0 (0	0	0	0	0	0
0.957	0) (0 (0	0	0	0	0	0
-0.993	0) (0 (0	0	0	0	0	0
1.000	0) (0 (0	0	0	0	0	0
0	1	. (0 (0	0	0	0	0	0
0	0)	1 (0	0	0	0	0	0
0	0) (0 2	1	0	0	0	0	0
0	0) (0 (0	1	0	0	1	0
0	0) (0 (0	0	1	0	0	0
0	0) (0 (0	0	0	1	0	0
0	0) (0 (0	1	0	0	1	0
0	0) (0 (0	0	0	0	0	1
0	0) (0 (0	0	0	0	0	0
0	0) (0 (0	0	0	0	0	0

k _{0 Au} (m)	G_{tha}	G_{ea}	G_{thm}	G _{e m}	f	α	Q_{0a}	E _{ra}	
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0

0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Covariance matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

	a ₁	a ₀	a_1	a_2	a_3	$E_{\gamma m}$	$E_{\gamma a}$
a ₁	1.9E-03	-2.4E-03	7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00
a ₀	-2.4E-03	3.2E-03	-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00
a ₋₁	7.5E-04	-1.1E-03	3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00
a_2	-7.7E-05	1.1E-04	-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00
a_3	2.4E-06	-3.6E-06	1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00
$E_{\gamma m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08	0.0E+00
$E_{\gamma a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08
$\Delta {\rm d}_{\rm a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\Delta d_{\rm m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\delta\epsilon_{ra}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
δε _{r m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	2.3E-01	0.0E+00	-2.2E-01	-4.3E-01	-6.4E-01	-5.8E-01	7.1E-01

 $\mathbf{C}_{\mathbf{i}}$

$c_{\gamma 2 a}$	P _{γ2 a}		Ci		a ₁	a ₀	a ₋₁
	0	0	-2.4E-02	a ₁	1.9E-03	-2.4E-03	7.5E-04
	0	0	1.0E-02	a ₀	-2.4E-03	3.2E-03	-1.1E-03
	0	0	3.3E-02	a_1	7.5E-04	-1.1E-03	3.8E-04
	0	0	4.7E-02	a_2	-7.7E-05	1.1E-04	-4.3E-05
	0	0	5.6E-02	a_3	2.4E-06	-3.6E-06	1.4E-06
	0	0	1.1E-04	$E_{\gamma 2} m$	0.0E+00	0.0E+00	0.0E+00
	0	0	-1.7E-01	$a_{\gamma 2} m$	0.0E+00	0.0E+00	0.0E+00
	0	0	-1.7E-01	$C_{\gamma 2}$ m	0.0E+00	0.0E+00	0.0E+00
	0	0	8.6E-01	$P/T_{\gamma 2 m}$	0.0E+00	0.0E+00	0.0E+00
	0	0	-1.3E-04	$E_{\gamma 1 \text{ a}}$	0.0E+00	0.0E+00	0.0E+00
	0	0	1.8E-01	$P_{\gamma 1} a$	0.0E+00	0.0E+00	0.0E+00
	0	0	-8.4E-01	$P/T_{\gamma 1 a}$	0.0E+00	0.0E+00	0.0E+00
	0	0	1.8E-01	$a_{\gamma 2 a}$	0.0E+00	0.0E+00	0.0E+00
	1	0	1.8E-01	$C_{\gamma 2}$ a	0.0E+00	0.0E+00	0.0E+00
	0	1	-1.8E-01	$P_{\gamma 2 a}$	0.0E+00	0.0E+00	0.0E+00

Covariance matrix of $\text{COI}_{\text{m}}/\text{COI}_{\text{a}}$

c_i -2.4E-02 1.0E-02 3.3E-02

Q _{0 m}	E _{rm}	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	° COI _m / CO	I _a m _m	m _a	w _m	
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

0	0	0	0	0	0	0
1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	1	0
0	0	0	0	0	0	1
0	0	0	0	0	0	0

Δd_a	Δd_m	δε _{r a}		δε _{r m}	
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
8.3E-02	0.0E+00		0.0E+00		0.0E+00
0.0E+00	8.3E-02		0.0E+00		0.0E+00
0.0E+00	0.0E+00		2.9E-05		3.0E-05
0.0E+00	0.0E+00		3.0E-05		3.1E-05
3.7E-02	-3.8E-02		0.0E+00		0.0E+00

a_2	a_3	E _{γ2 m}	$a_{\gamma 2 m}$	C _{γ2 m}	Ρ/Τ _{γ2 m}	$E_{\gamma 1}$ a
-7.7E-05	2.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.1E-04	-3.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-4.3E-05	1.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4.9E-06	-1.7E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.7E-07	5.7E-09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	1.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-04	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-02
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.7E-04	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4.7E-02	5.6E-02	1.1E-04	-1.7E-01	-1.7E-01	8.6E-01	-1.3E-04

Covariance matrix of ρ_{a}

	C _i		t _i	μ	
0	2.3E-18	t _i		3.0E+02	0.0E+00
0	-2.5E-12	μ		0.0E+00	2.5E-07
0	5.0E-18	t _{1/2 a}		0.0E+00	0.0E+00
0	-3.0E-19	t _{1/2 m}		0.0E+00	0.0E+00
0	4.8E-18	t _{d a}		0.0E+00	0.0E+00
0	4.1E-18	t _{ca}		0.0E+00	0.0E+00
0	-4.2E-17	t _{la}		0.0E+00	0.0E+00
0	-2.1E-19	t _{d m}		0.0E+00	0.0E+00
0	-2.6E-15	t _{c m}		0.0E+00	0.0E+00
0	7.1E-14	t _{l m}		0.0E+00	0.0E+00
0	3.9E-16	n _{pa}		0.0E+00	0.0E+00
0	-3.7E-16	n _{pm}		0.0E+00	0.0E+00
0	-4.2E-11	k _{o Au} (a)		0.0E+00	0.0E+00
0	3.8E-11	k _{o Au} (m)		0.0E+00	0.0E+00
0	-4.9E-11	G _{th a}		0.0E+00	0.0E+00
0	-1.4E-12	G _{e a}		0.0E+00	0.0E+00
0	4.4E-11	G _{th m}		0.0E+00	0.0E+00
0	6.6E-12	G _{e m}		0.0E+00	0.0E+00
0	-3.3E-13	f		0.0E+00	0.0E+00
0	-2.6E-11	CL.		0.0E+00	0.0E+00
0	-4.3E-12	Q _{0 a}		0.0E+00	0.0E+00

0	-3.0E-20	E _{ra}	0.0E+00	0.0E+00
0	3.4E-12	Q _{0 m}	0.0E+00	0.0E+00
0	1.4E-15	Erm	0.0E+00	0.0E+00
0	6.4E-11	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	0.0E+00	0.0E+00
0	5.0E-11	COI _m / COI _a	0.0E+00	0.0E+00
0	6.0E-09	m _m	0.0E+00	0.0E+00
0	-2.1E-10	m _a	0.0E+00	0.0E+00
0	1.1E-08	W _m	0.0E+00	0.0E+00
1	-5.1E-13	υ	0.0E+00	0.0E+00

c_i 2.3E-18 -2.5E-12

$P_{\gamma 1 a}$	P/T	y1a a	γ2 a C _{γ2 a}	P _{γ2 a}	
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	5.7E-04	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	1.3E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	6.3E-04	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-06
	1.8E-01	-8.4E-01	1.8E-01	1.8E-01	-1.8E-01

t _{1/2 a}	t _{1/2 m}	t _{d a}	t _{c a}	t _{la}	t _{d m}	
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	3.0E+06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	6.7E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.2E+03	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E+03
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
5.0E-18	-3.0E-19	4.8E-18	4.1E-18	-4.2E-17	-2.1E-19

t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)	k _{o Au} (m)
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	6.4E+05	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	1.9E+05	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E-05	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-05
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-2.6E-15	7.1E-14	3.9E-16	-3.7E-16	-4.2E-11	3.8E-11

1	~		
(-		
	-	÷	2

G _{e a}	G _{th m}	G _{em}	f	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-01
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-4.9E-11	-1.4E-12	4.4E-11	6.6E-12	-3.3E-13

CL.	Q _{0 a}	E _{ra}	Q _{0 m}	E _{rm}	ε _{p m}	^{geo} / ε _{pa} geo
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	4.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	7.4E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	7.6E+05	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	3.6E-03	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.8E+01	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.9E-04
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-2.6E-11	-4.3E-12	-3.0E-20	3.4E-12	1.4E-15	6.4E-11

COI _m / COI _a	m _m		m _a	W _m	υ
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.9E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	2.5E-09	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	2.5E-09	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	2.1E-09	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E+00
5.0E-11	6.0E-09	-2.1E-10	1.1E-08	-5.1E-13

Irradiation and γ -spectrometry

end irradiation	9/12/2017	2.46 PM
irradiation time / s	21600	

library	CSF.Lib
calib	OR50_source2016_geom_cont_12052017.Clb
sm type	CSF.Lib (ROI32 Analysis)

Nuclide	Channel	End	ergy	Background
86Rb		4307.77	1077	49054
Co60		4691.96	1173.2	5220
	target	pro	oduct	
analite, a	⁸⁵ Rb	⁸⁶ R	b	
monitor, m	⁵⁹ Co	⁶⁰ C	o	

Uncertainty budget of ρ_{a}

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x i
t _i		S	21600
μ		1	0.0445
t _{1/2 a}		S	1609632
	λ_{a}	s ⁻¹	4.3E-07
t _{1/2 m}		S	1.7E+08
	λ_{m}	s ⁻¹	4.2E-09
t _{d a}		S	2404405
t _{ca}		S	1292628
t _{la}		S	1264268
t _{d m}		S	3722775
t _{c m}		S	797
t _{l m}		S	740
	δ_{a}	1	1.022
	δ_{m}	1	1.077
	ξa	1	1.00098
	ξm	1	1.00319
n _{pa}		1	4559
n _{pm}		1	137487
k _{o Au} (a)		1	0.0007650
k _{0 Au} (m)		1	1.3200
${\sf G}_{\sf tha}$		1	1

G _{e a}		1		1
G _{th m}		1		1
G _{e m}		1		1
f		1		15.60
α		1		-0.0360
Q _{0 a}		1		14.80
E _{ra}		eV		839
	$Q_{0a}(\alpha)$	1		18.76
Q _{0 m}		1		1.993
E _{rm}		eV		136.0
	$Q_{0m}(\alpha)$	1		2.319
ϵ_{pm}^{geo} / ϵ_{pa}^{geo}		1		0.9306
COI_m / COI_a		1		0.857
m _m		g		0.00847
m _a		g		0.24000
w _m		g g ⁻¹		0.004597
υ		mg L ⁻¹		99.2
Υ		[Y]	У	
$ ho_a$		g mL⁻¹		8.00E-10

Uncertainty budget of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
a ₁		Mev-1	-0.472
a ₀			1 -3.229
a ₋₁		Mev	0.403
a_2		Mev2	-0.0320
a ₋₃		Mev3	0.000573
E _{γ m}		MeV	1.17320
$E_{\gamma a}$		MeV	1.07700
Δd_a		mm	0
Δd_{m}		mm	0
	e ₄	keV-4	-7.1E-11
	e ₃	keV-3	5.2E-08
	e ₂	keV-2	-1.4E-05
	e ₁	keV-1	1.8E-03
	e ₀		1 -4.5E-02
	d_1	keV-1	5.6E-06

d _o		1	4.2E-02
$\delta\epsilon_{ra}$	mm ⁻¹		0.048
δε _{rm}	mm⁻¹		0.048
Y	[Y]	У	
ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	1		0.931

Uncertainty budget of COI_{m} / COI_{a}

Input Quantity	Quantity	Unit	Valu	le
	X _i	[X _i]	x _i	
2		NAcy 1		0 472
a ₁		iviev-1		-0.472
a ₀			1	-3.229
a ₋₁		Mev		0.403
a_2		Mev2		-0.0320
a ₋₃		Mev3		0.000573
	b ₁		1	-0.571
	b ₀		1	1.079
	C ₂		1	-1.625
	C ₁		1	6.678
	C ₀		1	-7.006
E _{γ2 m}		keV		1332.5
a _{γ2 m}			1	1.000
$C_{\gamma 2 m}$			1	1.000
Ρ/Τ _{γ2 m}			1	0.197
	Y	[Y]	У	
	COI _m / COI _a		1	0.857

Net area	Cnts/s	Uncert	% FWH	M	source file	start counting
	4559	0.004	9.68	1.958	OR50_20171025_	_CSF_si 10/10/2017
13	7487 18	5.919	0.32	1.798	OR50_20170925	_Co_sa 10/25/2017

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	$u_y^2(x_i)$		x _i +u(x _i)	$y(x_i+u(x_i))$
17	0.1%	1.7E-16	8.7E-30	0.0%	2.2E+04	8.0E-10
0.0005	1.1%	-4.0E-11	3.9E-28	0.0%	4.5E-02	8.0E-10
1728	0.1%	-1.5E-16	6.3E-26	0.0%	1.6E+06	8.0E-10
4.6E-10	0.1%					
2.6E+04	0.0%	-4.7E-18	1.5E-26	0.0%	1.7E+08	8.0E-10
6.5E-13	0.0%					
35	0.0%	3.4E-16	1.4E-28	0.0%	2.4E+06	8.0E-10
0.3	0.0%	1.8E-16	2.8E-33	0.0%	1.3E+06	8.0E-10
0.3	0.0%	-6.6E-16	3.6E-32	0.0%	1.3E+06	8.0E-10
35	0.0%	-3.3E-18	1.3E-32	0.0%	3.7E+06	8.0E-10
0.3	0.0%	-4.1E-14	1.4E-28	0.0%	8.0E+02	8.0E-10
0.3	0.0%	1.1E-12	1.1E-25	0.0%	7.4E+02	8.0E-10
0.000	0.0%					
0.001	0.1%					
0.00001	0.0%					
0.00004	0.0%					
441	9.7%	1.8E-13	6.0E-21	83.4%	5.0E+03	8.8E-10
440	0.3%	-5.8E-15	6.5E-24	0.1%	1.4E+05	8.0E-10
0.0000077	1.0%	-1.0E-06	6.4E-23	0.9%	7.7E-04	7.9E-10
0.0053	0.4%	6.1E-10	1.0E-23	0.1%	1.3E+00	8.0E-10
0	0.0%	-3.6E-10	0.0E+00	0.0%	1.0E+00	8.0E-10

0	0.0%	-4.4E-10	0.0E+00	0.0%	1.0E+00	8.0E-10
0	0.0%	7.0E-10	0.0E+00	0.0%	1.0E+00	8.0E-10
0	0.0%	1.0E-10	0.0E+00	0.0%	1.0E+00	8.0E-10
0.33	2.1%	2.1E-11	4.9E-23	0.7%	1.6E+01	8.1E-10
0.0064	17.8%	2.4E-09	2.5E-22	3.4%	-3.0E-02	8.2E-10
0.37	2.5%	-3.0E-11	1.2E-22	1.7%	1.5E+01	7.9E-10
50	6.0%	-1.8E-14	8.5E-25	0.0%	8.9E+02	8.0E-10
0.92	4.9%					
0.060	3.0%	5.3E-11	1.0E-23	0.1%	2.1E+00	8.0E-10
6.9	5.1%	2.2E-14	2.3E-26	0.0%	1.4E+02	8.0E-10
0.095	4.1%					
0.0184	2.0%	8.6E-10	2.5E-22	3.5%	9.5E-01	8.2E-10
0.017	2.0%	9.3E-10	2.5E-22	3.5%	8.7E-01	8.2E-10
0.00005	0.6%	9.4E-08	2.2E-23	0.3%	8.5E-03	8.0E-10
0.00005	0.0%	-3.3E-09	2.8E-26	0.0%	2.4E-01	8.0E-10
0.000046	1.0%	1.7E-07	6.4E-23	0.9%	4.6E-03	8.1E-10
1.2	1.2%	-8.1E-12	9.4E-23	1.3%	1.0E+02	7.9E-10

u_c(y)

u_{cr}(y)

Σ

8.5E-11	10.6%	100.0%
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Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	c _i	u ² _y (x _i)		$x_i + u(x_i)$	y(x _i +u(x _i))
0.043	9.2%	9.0E-02	1.1E-05	3.3%	-4.3E-01	9.3E-01
0.057	1.8%	0.0E+00	0.0E+00	0.0%	-3.2E+00	9.3E-01
0.020	4.8%	-7.1E-02	-3.2E-06	-0.9%	4.2E-01	9.3E-01
0.0022	6.9%	-1.3E-01	5.7E-07	0.2%	-3.0E-02	9.3E-01
0.000075	13.1%	-1.7E-01	-2.3E-08	0.0%	6.5E-04	9.3E-01
0.00012	0.0%	-6.8E-01	6.1E-09	0.0%	1.2E+00	9.3E-01
0.00012	0.0%	7.2E-01	6.9E-09	0.0%	1.1E+00	9.3E-01
0.29		4.4E-02	1.6E-04	48.2%	2.9E-01	9.4E-01
0.29		-4.5E-02	1.7E-04	49.3%	2.9E-01	9.2E-01
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					

	0.019	2 0%			100.0%		
u _c (y)	U _{c r}	(y)		Σ			
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.4E-02	9.3E-01
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.3E-02	9.3E-01
	0.0000	0.0%					

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	$u_y^2(x_i)$		$x_i + u(x_i)$	$y(x_i+u(x_i))$
0.043	9.2%	-0.1901	1.7E-05	5.9%	-4.3E-01	8.5E-01
0.057	1.8%	-0.1427	-1.4E-05	-4.9%	-3.2E+00	8.5E-01
0.020	4.8%	-0.1070	3.0E-06	1.0%	4.2E-01	8.6E-01
0.0022	6.9%	-0.0803	-2.2E-07	-0.1%	-3.0E-02	8.6E-01
0.000075	13.1%	-0.0603	5.0E-09	0.0%	6.5E-04	8.6E-01
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0.1	0.0%	0.0001	1.2E-10	0.0%	1.3E+03	8.6E-01
0.012	1.2%	-0.1426	2.7E-06	0.9%	1.0E+00	8.6E-01
0.012	1.2%	-0.1426	2.7E-06	0.9%	1.0E+00	8.6E-01
0.023	11.5%	0.7343	2.8E-04	96.2%	2.2E-01	8.7E-01
u _c (y)	u _r (y)			Σ		

0.017 2.0% 100.0%

t	_c / s	t _I / s	t _{dead r} / %	t _d / s	t _c / t _{1/2}	t _d / t _{1/2}
10:39 AM	1292628	1264268	2.2%	2404405	0.80	1.5

10.39 AIVI	1292020	1204208	∠.∠/0	2404403	0.00	1
4:52 PM	797	740	7.2%	3722775	0.00	0.0

Covariance matrix of ρ_{a}

x_i -u (x_i)	$y(x_i - u(x_i))$						
			t _i	μ	t _{1/2 a}	t _{1/2 m}	
2.2E+04	4 8.0E-10	t _i		1	0	0	0
4.4E-02	2 8.0E-10	μ		0	1	0	0
1.6E+0	5 8.0E-10	t _{1/2 a}		0	0	1	0
		t _{1/2 m}		0	0	0	1
1.7E+08	8 8.0E-10	t _{d a}		0	0	0	0
		t _{ca}		0	0	0	0
2.4E+0	6 8.0E-10	t _{la}		0	0	0	0
1.3E+0	5 8.0E-10	t _{d m}		0	0	0	0
1.3E+0	5 8.0E-10	t _{c m}		0	0	0	0
3.7E+0	5 8.0E-10	t _{l m}		0	0	0	0
8.0E+02	2 8.0E-10	n _{pa}		0	0	0	0
7.4E+02	2 8.0E-10	n _{p m}		0	0	0	0
		k _{o Au} (a)		0	0	0	0
		k _{0 Au} (m)		0	0	0	0
		${\sf G}_{\sf tha}$		0	0	0	0
		G _{e a}		0	0	0	0
4.1E+03	3 7.2E-10	G _{th m}		0	0	0	0
1.4E+0	5 8.0E-10	G _{e m}		0	0	0	0
7.6E-04	4 8.1E-10	f		0	0	0	0
1.3E+00	0 8.0E-10	α		0	0	0	0
1.0E+0	0 8.0E-10	Q _{0 a}		0	0	0	0

1.0E+00	8.0E-10	E _{ra}	0	0	0	0
1.0E+00	8.0E-10	Q _{0 m}	0	0	0	0
1.0E+00	8.0E-10	Erm	0	0	0	0
1.5E+01	7.9E-10	ε_{pm}^{eo} / ε_{pa}^{l}	0	0	0	0
-4.2E-02	7.8E-10	COI_m / COI_a	0	0	0	0
1.4E+01	8.1E-10	m _m	0	0	0	0
7.9E+02	8.0E-10	m _a	0	0	0	0
		W _m	0	0	0	0
1.9E+00	8.0E-10	υ	0	0	0	0
1.3E+02	8.0E-10					
9.1E-01	7.8E-10					

8.4E-01	7.8E-10
8.4E-03	7.9E-10
2.4E-01	8.0E-10
4.6E-03	7.9E-10
9.8E+01	8.1E-10

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

			a_1		a ₀	a ₋₁	a ₋₂
-5.2E-01	9.3E-01	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	9.3E-01	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	9.3E-01	a ₋₁		0.884	-0.957	1.000	-0.984
-3.4E-02	9.3E-01	a ₋₂		-0.804	0.896	-0.984	1.000
5.0E-04	9.3E-01	a ₋₃		0.748	-0.848	0.957	-0.993
1.2E+00	9.3E-01	$E_{\gamma m}$		0	0	0	0
1.1E+00	9.3E-01	E_{\gammaa}		0	0	0	0
-2.9E-01	9.2E-01	$\Delta {\rm d}_{\rm a}$		0	0	0	0
-2.9E-01	9.4E-01	$\Delta {\rm d}_{\rm m}$		0	0	0	0
		$\delta\epsilon_{\text{ra}}$		0	0	0	0
		$\delta\epsilon_{rm}$		0	0	0	0

4.2E-02	9.3E-01
4.3E-02	9.3E-01

Correlation matrix of $\text{COI}_{\rm m}$ / $\text{COI}_{\rm a}$

$x_i - u(x_i)$	$y(x_i - u(x_i))$						
			a_1	a	0	a ₋₁	a ₋₂
-5.2E-01	8.7E-01	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	8.7E-01	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	8.6E-01	a ₋₁		0.884	-0.957	1.000	-0.984
-3.4E-02	8.6E-01	a ₋₂		-0.804	0.896	-0.984	1.000
5.0E-04	8.6E-01	a ₋₃		0.748	-0.848	0.957	-0.993
		$E_{\gamma 2 m}$		0	0	0	0
		a _{γ2 m}		0	0	0	0
		$c_{\gamma 2 m}$		0	0	0	0
		Ρ/Τ _{γ2 m}		0	0	0	0

1.3E+03	8.6E-01
9.9E-01	8.6E-01
9.9E-01	8.6E-01
1.7E-01	8.4E-01

t _{d a}	t _{ca}	t _{la}	t _{d m}	t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} ((a)
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0

		0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

a_3	$E_{\gamma m}$	$E_{\gamma a}$	$\Delta {\rm d_a}$	Δd_{m}	$\delta\epsilon_{ra}$	δε _{r m}		Ci
0.748	3	0	0	0	0	0	0	9.0E-02
-0.848	3	0	0	0	0	0	0	0.0E+00
0.957	7	0	0	0	0	0	0	-7.1E-02
-0.993	3	0	0	0	0	0	0	-1.3E-01
1.000)	0	0	0	0	0	0	-1.7E-01
()	1	0	0	0	0	0	-6.8E-01
()	0	1	0	0	0	0	7.2E-01
()	0	0	1	0	0	0	4.4E-02
()	0	0	0	1	0	0	-4.5E-02
()	0	0	0	0	1	1	0.0E+00
()	0	0	0	0	1	1	0.0E+00

Covariance

a ₋₃	$E_{\gamma 2 \ m}$	$a_{\gamma 2 m}$	$c_{\gamma 2 m}$	$P/T_{\gamma 2 m}$		Ci	
0.7	48	0	0	0	0	-1.9E-01	a_1
-0.8	348	0	0	0	0	-1.4E-01	a ₀
0.9	57	0	0	0	0	-1.1E-01	a_1
-0.9	93	0	0	0	0	-8.0E-02	a_2
1.0	000	0	0	0	0	-6.0E-02	a_3
	0	1	0	0	0	9.6E-05	$E_{\gamma 2} m$
	0	0	1	0	0	-1.4E-01	$a_{\gamma 2} m$
	0	0	0	1	0	-1.4E-01	$C_{\gamma 2} m$
	0	0	0	0	1	7.3E-01	$P/T_{\gamma 2 m}$

Ci
k _{0 Au} (m)	G_{tha}	G_{ea}	G_{thm}	G _{e m}	f	α	Q_{0a}	E _{ra}	
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0

0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Covariance matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

	a ₁	a ₀	a_1	a_2	a_3	$E_{\gamma m}$	$E_{\gamma a}$
a ₁	1.9E-03	-2.4E-03	7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00
a ₀	-2.4E-03	3.2E-03	-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00
a ₋₁	7.5E-04	-1.1E-03	3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00
a_2	-7.7E-05	1.1E-04	-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00
a_3	2.4E-06	-3.6E-06	1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00
$E_{\gamma m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08	0.0E+00
$E_{\gamma a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08
$\Delta {\rm d}_{\rm a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\Delta d_{\rm m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\delta\epsilon_{ra}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
δε _{r m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	9.0E-02	0.0E+00	-7.1E-02	-1.3E-01	-1.7E-01	-6.8E-01	7.2E-01

 $\mathbf{C}_{\mathbf{i}}$

matrix of COI_m/COI_a

a ₁	a ₀	a_1	a_2	a_3	$E_{\gamma 2} m$	$a_{\gamma 2 m}$	$C_{\gamma 2} m$	$P/T_{\gamma 2 m}$
1.9E-03	-2.4E-03	7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-2.4E-03	3.2E-03	-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
7.5E-04	-1.1E-03	3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-7.7E-05	1.1E-04	-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.4E-06	-3.6E-06	1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-02	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-04
-1.9E-01	-1.4E-01	-1.1E-01	-8.0E-02	-6.0E-02	9.6E-05	-1.4E-01	-1.4E-01	7.3E-01

Q _{0 m}	E _{rm}	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	° COI _m / CO	I _a m _m	m _a	w _m	
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

0	0	0	0	0	0	0
1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	1	0
0	0	0	0	0	0	1
0	0	0	0	0	0	0

Δd_a	Δd_m	δε _{r a}		δε _{r m}
0.0E+00	0.0E+00		0.0E+00	0.0E+00
0.0E+00	0.0E+00		0.0E+00	0.0E+00
0.0E+00	0.0E+00		0.0E+00	0.0E+00
0.0E+00	0.0E+00		0.0E+00	0.0E+00
0.0E+00	0.0E+00		0.0E+00	0.0E+00
0.0E+00	0.0E+00		0.0E+00	0.0E+00
0.0E+00	0.0E+00		0.0E+00	0.0E+00
8.3E-02	0.0E+00		0.0E+00	0.0E+00
0.0E+00	8.3E-02		0.0E+00	0.0E+00
0.0E+00	0.0E+00		3.0E-05	3.1E-05
0.0E+00	0.0E+00		3.1E-05	3.1E-05
4.4E-02	-4.5E-02		0.0E+00	0.0E+00

Covariance matrix of ρ_{a}

	C _i		t _i	μ	
0	1.7E-16	ti		3.0E+02	0.0E+00
0	-4.0E-11	μ		0.0E+00	2.5E-07
0	-1.5E-16	t _{1/2 a}		0.0E+00	0.0E+00
0	-4.7E-18	t _{1/2 m}		0.0E+00	0.0E+00
0	3.4E-16	t _{d a}		0.0E+00	0.0E+00
0	1.8E-16	t _{ca}		0.0E+00	0.0E+00
0	-6.6E-16	t _{l a}		0.0E+00	0.0E+00
0	-3.3E-18	t _{d m}		0.0E+00	0.0E+00
0	-4.1E-14	t _{c m}		0.0E+00	0.0E+00
0	1.1E-12	t _{l m}		0.0E+00	0.0E+00
0	1.8E-13	n _{pa}		0.0E+00	0.0E+00
0	-5.8E-15	n _{p m}		0.0E+00	0.0E+00
0	-1.0E-06	k _{o Au} (a)		0.0E+00	0.0E+00
0	6.1E-10	k _{o Au} (m)		0.0E+00	0.0E+00
0	-3.6E-10	G _{th a}		0.0E+00	0.0E+00
0	-4.4E-10	G _{ea}		0.0E+00	0.0E+00
0	7.0E-10	G _{th m}		0.0E+00	0.0E+00
0	1.0E-10	G _{e m}		0.0E+00	0.0E+00
0	2.1E-11	f		0.0E+00	0.0E+00
0	2.4E-09	CL		0.0E+00	0.0E+00
0	-3.0E-11	Q _{0 a}		0.0E+00	0.0E+00

0	-1.8E-14	E _{ra}	0.0E+00	0.0E+00
0	5.3E-11	Q _{0 m}	0.0E+00	0.0E+00
0	2.2E-14	Erm	0.0E+00	0.0E+00
0	8.6E-10	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	0.0E+00	0.0E+00
0	9.3E-10	COI _m / COI _a	0.0E+00	0.0E+00
0	9.4E-08	m _m	0.0E+00	0.0E+00
0	-3.3E-09	m _a	0.0E+00	0.0E+00
0	1.7E-07	W _m	0.0E+00	0.0E+00
1	-8.1E-12	υ	0.0E+00	0.0E+00

c_i 1.7E-16 -4.0E-11

t _{1/2 a}	t _{1/2 m}	t _{d a}	t _{c a}	t _{la}	t _{d m}	
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	3.0E+06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	6.7E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.2E+03	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E+03
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.5E-16	-4.7E-18	3.4E-16	1.8E-16	-6.6E-16	-3.3E-18

t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)	k _{o Au} (m)
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.9E+05	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	1.9E+05	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.9E-11	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-05
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-4.1E-14	1.1E-12	1.8E-13	-5.8E-15	-1.0E-06	6.1E-10

1	~		
(-		
	-	÷	2

G _{e a}	G _{th m}	G _{em}	f	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-01
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-3.6E-10	-4.4E-10	7.0E-10	1.0E-10	2.1E-11

CL	Q _{0 a}	E _{ra}	Q _{0 m}	Erm	ε _{p m}	^{geo} / ε _{pa} geo
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	4.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	1.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	2.5E+03	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	3.6E-03	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.8E+01	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.4E-04
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.4E-09	-3.0E-11	-1.8E-14	5.3E-11	2.2E-14	8.6E-10

COI _m / COI _a	m _m		m _a	W _m	υ
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.9E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	2.5E-09	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	2.5E-09	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	2.1E-09	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E+00
9.3E-10	9.4E-08	-3.3E-09	1.7E-07	-8.1E-12

Irradiation and γ -spectrometry

end irradiation	9/12/2017	2.46 PM
irradiation time / s	21600	

library	CSF.Lib
calib	OR50_source2016_geom_cont_12052017.Clb
sm type	CSF.Lib (ROI32 Analysis)

Nuclide	Channel	E	nergy	Background
59Fe		4396.05	1099.3	47748
Co60		4691.96	1173.2	5220
	target	р	roduct	
analite, a	⁵⁸ Fe	59	Fe	
monitor, m	⁵⁹ Co	60	°Co	

Uncertainty budget of ρ_{a}

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
t _i		S	21600
μ		1	0.0445
t _{1/2 a}		S	3844800
	λ_{a}	s ⁻¹	1.8E-07
t _{1/2 m}		S	1.7E+08
	λ_{m}	s ⁻¹	4.2E-09
t _{d a}		S	2404405
t _{ca}		S	1292628
t _{la}		S	1264268
t _{d m}		S	3722775
t _{c m}		S	797
t _{l m}		S	740
	δ_{a}	1	1.022
	δ_{m}	1	1.077
	ξa	1	1.00098
	ξm	1	1.00319
n _{pa}		1	9456
n _{pm}		1	137487
k _{o Au} (a)		1	0.00007770
k _{0 Au} (m)		1	1.3200
${\sf G}_{\sf tha}$		1	1

G _{e a}		1		1
G _{th m}		1		1
G _{e m}		1		1
f		1		15.60
α		1		-0.0360
Q _{0 a}		1		0.975
E _{ra}		eV		637
	$Q_{0a}(\alpha)$	1		1.14
Q _{0 m}		1		1.993
E _{rm}		eV		136.0
	Q _{0 m} (α)	1		2.319
$\epsilon_{ m pm}^{ m geo}$ / $\epsilon_{ m pa}^{ m geo}$		1		0.9466
$\text{COI}_{\text{m}} / \text{COI}_{\text{a}}$		1		0.868
m _m		g		0.00847
m _a		g		0.24000
w _m		g g⁻¹		0.004597
υ		${\sf mg} {\sf L}^{-1}$		99.2
Υ		[Y]	У	
$ ho_{a}$		g mL ⁻¹		3.87E-08

Uncertainty budget of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
a ₁		Mev-1	-0.472
a ₀			1 -3.229
a ₋₁		Mev	0.403
a_2		Mev2	-0.0320
a ₋₃		Mev3	0.000573
E _{γ m}		MeV	1.17320
$E_{\gamma a}$		MeV	1.09930
Δd_a		mm	0
Δd_{m}		mm	0
	e ₄	keV-4	-7.1E-11
	e ₃	keV-3	5.2E-08
	e ₂	keV-2	-1.4E-05
	e ₁	keV-1	1.8E-03
	e ₀		1 -4.5E-02
	d1	keV-1	5.6E-06

d _o		1	4.2E-02
$\delta\epsilon_{ra}$	mm ⁻¹		0.048
δε _{rm}	mm⁻¹		0.048
Y	[Y]	У	
$\varepsilon_{p m}^{geo} / \varepsilon_{p a}^{geo}$	1		0.947

Uncertainty budget of COI_{m} / COI_{a}

Input Quantity	Quantity	Unit	Value
	X _i	[X _i]	x _i
a ₁		Mev-1	-0.472
a ₀			1 -3.229
a ₋₁		Mev	0.403
a ₋₂		Mev2	-0.0320
a ₋₃		Mev3	0.000573
	b ₁		1 -0.571
	b ₀		1 1.079
	C ₂		1 -1.625
	c ₁		1 6.678
	c ₀		1 -7.006
E _{γ2 m}		keV	1332.5
a _{γ2 m}			1 1.000
C _{γ2 m}			1 1.000
Ρ/Τ _{γ2 m}			1 0.197
$E_{\gamma 4 a}$		keV	192.3
P _{γ4 a}			1 2.95%
Ρ/Τ _{γ4 a}			1 0.595
a _{γ5 a}			1 1.000
$C_{\gamma 5 a}$			1 1.000
$P_{\gamma 5 a}$			1 56.1%
	Y	[Y]	У
	COI _m / COI _a		1 0.868

start counting	source file	VHM	% FW	Uncert %	Cnts/s		Net area
10/10/2017	OR50_20171025_CSF_si	1.895	6.2		0.007	9456	
10/25/2017	OR50_20170925_Co_sa	1.798	0.32	(185.919	137487	1

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	u ² _y (x _i)		$x_i + u(x_i)$	$y(x_i+u(x_i))$
17	0.1%	3.4E-15	3.5E-27	0.0%	2.2E+04	3.9E-08
0.0005	1.1%	-1.9E-09	9.2E-25	0.0%	4.5E-02	3.9E-08
518	0.0%	4.6E-15	5.6E-24	0.0%	3.8E+06	3.9E-08
2.4E-11	0.0%					
2.6E+04	0.0%	-2.3E-16	3.5E-23	0.0%	1.7E+08	3.9E-08
6.5E-13	0.0%					
35	0.0%	7.0E-15	5.8E-26	0.0%	2.4E+06	3.9E-08
0.3	0.0%	4.7E-15	1.8E-30	0.0%	1.3E+06	3.9E-08
0.3	0.0%	-3.2E-14	8.5E-29	0.0%	1.3E+06	3.9E-08
35	0.0%	-1.6E-16	3.1E-29	0.0%	3.7E+06	3.9E-08
0.3	0.0%	-2.0E-12	3.4E-25	0.0%	8.0E+02	3.9E-08
0.3	0.0%	5.4E-11	2.5E-22	0.0%	7.4E+02	3.9E-08
0.000	0.0%					
0.001	0.1%					
0.00001	0.0%					
0.00004	0.0%					
586	6.2%	4.1E-12	5.8E-18	78.0%	1.0E+04	4.1E-08
440	0.3%	-2.8E-13	1.5E-20	0.2%	1.4E+05	3.9E-08
0.0000039	0.5%	-5.0E-04	3.7E-20	0.5%	7.8E-05	3.9E-08
0.0053	0.4%	2.9E-08	2.4E-20	0.3%	1.3E+00	3.9E-08
0	0.0%	-3.6E-08	0.0E+00	0.0%	1.0E+00	3.9E-08

0	0.0%	-2.6E-09	0.0E+00	0.0%	1.0E+00	3.9E-08
0	0.0%	3.4E-08	0.0E+00	0.0%	1.0E+00	3.9E-08
0	0.0%	5.0E-09	0.0E+00	0.0%	1.0E+00	3.9E-08
0.33	2.1%	-1.5E-10	2.5E-21	0.0%	1.6E+01	3.9E-08
0.0064	17.8%	-9.4E-09	3.6E-21	0.0%	-3.0E-02	3.9E-08
0.010	1.0%	-2.9E-09	8.1E-22	0.0%	9.8E-01	3.9E-08
153	24.0%	-9.2E-14	2.0E-22	0.0%	7.9E+02	3.9E-08
0.04	3.1%					
0.060	3.0%	2.6E-09	2.4E-20	0.3%	2.1E+00	3.9E-08
6.9	5.1%	1.1E-12	5.5E-23	0.0%	1.4E+02	3.9E-08
0.095	4.1%					
0.0187	2.0%	4.1E-08	5.8E-19	7.9%	9.7E-01	3.9E-08
0.016	1.8%	4.5E-08	5.1E-19	6.9%	8.8E-01	3.9E-08
0.00005	0.6%	4.6E-06	5.2E-20	0.7%	8.5E-03	3.9E-08
0.00005	0.0%	-1.6E-07	6.5E-23	0.0%	2.4E-01	3.9E-08
0.000046	1.0%	8.4E-06	1.5E-19	2.0%	4.6E-03	3.9E-08
1.2	1.2%	-3.9E-10	2.2E-19	3.0%	1.0E+02	3.8E-08

u_c(y)

u_{cr}(y)

Σ

2.7E-09	7.0%	100.0%

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	u² _y (x _i)		$x_i + u(x_i)$	$y(x_i+u(x_i))$
0.043	9.2%	7.0E-02	6.9E-06	2.0%	-4.3E-01	9.5E-01
0.057	1.8%	0.0E+00	0.0E+00	0.0%	-3.2E+00	9.5E-01
0.020	4.8%	-5.4E-02	-1.9E-06	-0.6%	4.2E-01	9.5E-01
0.0022	6.9%	-9.6E-02	3.4E-07	0.1%	-3.0E-02	9.5E-01
0.000075	13.1%	-1.3E-01	-1.4E-08	0.0%	6.5E-04	9.5E-01
0.00012	0.0%	-6.9E-01	6.3E-09	0.0%	1.2E+00	9.5E-01
0.00012	0.0%	7.2E-01	6.9E-09	0.0%	1.1E+00	9.5E-01
0.29		4.5E-02	1.7E-04	48.8%	2.9E-01	9.6E-01
0.29		-4.6E-02	1.7E-04	49.7%	2.9E-01	9.3E-01
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					

0.000 0.0%

	0.010	2.0%			100.0%		
u _c (y)	U _{c r}	(y)		Σ			
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.4E-02	9.5E-01
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.3E-02	9.5E-01
	0.0000	0.0%					

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	u ² _y (x _i)		$x_i + u(x_i)$	$y(x_i+u(x_i))$
0.043	9.2%	-0.1904	1.7E-05	6.6%	-4.3E-01	8.6E-01
0.057	1.8%	-0.1339	-1.3E-05	-5.2%	-3.2E+00	8.6E-01
0.020	4.8%	-0.0539	1.5E-06	0.6%	4.2E-01	8.7E-01
0.0022	6.9%	0.2016	5.3E-07	0.2%	-3.0E-02	8.7E-01
0.000075	13.1%	1.4091	-1.1E-07	0.0%	6.5E-04	8.7E-01
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0.1	0.0%	0.0001	1.3E-10	0.0%	1.3E+03	8.7E-01
0.012	1.2%	-0.1443	2.8E-06	1.1%	1.0E+00	8.7E-01
0.012	1.2%	-0.1443	2.8E-06	1.1%	1.0E+00	8.7E-01
0.023	11.5%	0.7431	2.6E-04	103.1%	2.2E-01	8.8E-01
0.12	0.1%	0.0000	1.9E-11	0.0%	1.9E+02	8.7E-01
0.01%	0.4%	0.3544	1.7E-09	0.0%	3.0E-02	8.7E-01
0.069	11.5%	-0.0178	-1.9E-05	-7.5%	6.6E-01	8.7E-01
0.012	1.2%	0.0105	1.5E-08	0.0%	1.0E+00	8.7E-01
0.012	1.2%	0.0105	1.5E-08	0.0%	1.0E+00	8.7E-01
0.12%	0.2%	-0.0186	4.6E-10	0.0%	5.6E-01	8.7E-01

u_c(y) u_r(y)

Σ

0.016 1.8%

100.0%

t _c / s	t _i / s	t _{dead r} / %	t _d / s	t _c / t _{1/2}	t _d / t _{1/2}

10:39 AM	1292628	1264268	2.2%	2404405	0.34	0.6
4:52 PM	797	740	7.2%	3722775	0.00	0.0

Correlation matrix of ρ_{a}

$x_i - u(x_i)$	$y(x_i - u(x_i))$						
			t _i	μ	t _{1/2 a}	t _{1/2 m}	
2.2E+04	3.9E-08	t _i		1	0	0	0
4.4E-02	3.9E-08	μ		0	1	0	0
3.8E+06	3.9E-08	t _{1/2 a}		0	0	1	0
		t _{1/2 m}		0	0	0	1
1.7E+08	3.9E-08	t _{d a}		0	0	0	0
		t _{ca}		0	0	0	0
2.4E+06	3.9E-08	t _{la}		0	0	0	0
1.3E+06	3.9E-08	t _{d m}		0	0	0	0
1.3E+06	3.9E-08	t _{c m}		0	0	0	0
3.7E+06	3.9E-08	t _{l m}		0	0	0	0
8.0E+02	3.9E-08	n _{pa}		0	0	0	0
7.4E+02	3.9E-08	n _{p m}		0	0	0	0
		k _{o Au} (a)		0	0	0	0
		k _{0 Au} (m)		0	0	0	0
		G_{tha}		0	0	0	0
		G _{e a}		0	0	0	0
8.9E+03	3.6E-08	G _{th m}		0	0	0	0
1.4E+05	3.9E-08	G _{e m}		0	0	0	0
7.7E-05	3.9E-08	f		0	0	0	0
1.3E+00	3.9E-08	α		0	0	0	0
1.0E+00	3.9E-08	Q _{0 a}		0	0	0	0

1.0E+00	3.9E-08	E _{ra}	0	0	0	0
1.0E+00	3.9E-08	Q _{0 m}	0	0	0	0
1.0E+00	3.9E-08	Erm	0	0	0	0
1.5E+01	3.9E-08	ϵ_{pm}^{eo} / ϵ_{pa}	0	0	0	0
-4.2E-02	3.9E-08	COI_m / COI_a	0	0	0	0
9.7E-01	3.9E-08	m _m	0	0	0	0
4.8E+02	3.9E-08	m _a	0	0	0	0
		w _m	0	0	0	0
1.9E+00	3.9E-08	υ	0	0	0	0
1.3E+02	3.9E-08					

9.3E-01	3.8E-08
8.5E-01	3.8E-08
8.4E-03	3.8E-08
2.4E-01	3.9E-08
4.6E-03	3.8E-08
9.8E+01	3.9E-08

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

			a_1		a ₀	a_1	a ₋₂
-5.2E-01	9.4E-01	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	9.5E-01	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	9.5E-01	a ₋₁		0.884	-0.957	1.000	-0.984
-3.4E-02	9.5E-01	a_2		-0.804	0.896	-0.984	1.000
5.0E-04	9.5E-01	a ₋₃		0.748	-0.848	0.957	-0.993
1.2E+00	9.5E-01	$E_{\gamma m}$		0	0	0	0
1.1E+00	9.5E-01	$E_{\gamma a}$		0	0	0	0
-2.9E-01	9.3E-01	Δd_{a}		0	0	0	0
-2.9E-01	9.6E-01	Δd_{m}		0	0	0	0
		$\delta\epsilon_{ra}$		0	0	0	0
		δε _{r m}		0	0	0	0

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of $\ensuremath{\mathsf{COI}_{\mathsf{m}}}\xspace$ / $\ensuremath{\mathsf{COI}_{\mathsf{m}}}\xspace$ / $\ensuremath{\mathsf{COI}_{\mathsf{m}}}\xspace$

			a_1		a ₀	a ₋₁	a_2
-5.2E-01	8.8E-01	a1		1.000	-0.973	0.884	-0.804
-3.3E+00	8.8E-01	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	8.7E-01	a_1		0.884	-0.957	1.000	-0.984
-3.4E-02	8.7E-01	a_2		-0.804	0.896	-0.984	1.000
5.0E-04	8.7E-01	a ₋₃		0.748	-0.848	0.957	-0.993
		$E_{\gamma 2\;m}$		0	0) C) 0
		$a_{\gamma 2\ m}$		0	0) C) 0
		$c_{\gamma 2 \ m}$		0	0) C) 0
		$P/T_{\gamma 2 m}$		0	0) C) 0
		$E_{\gamma 4 \text{ a}}$		0	0) C) 0
1.3E+03	8.7E-01	$P_{\gamma4a}$		0	0) C) 0
9.9E-01	8.7E-01	$P/T_{\gamma 4 a}$		0	0) C) 0
9.9E-01	8.7E-01	$a_{\gamma 5 a}$		0	0) C) 0
1.7E-01	8.5E-01	$c_{\gamma 5 a}$		0	0) C) 0
1.9E+02	8.7E-01	$P_{\gamma 5 a}$		0	0) C) 0
2.9E-02	8.7E-01						
5.3E-01	8.7E-01						
9.9E-01	8.7E-01						
9.9E-01	8.7E-01						

5.6E-01 8.7E-01

t _{d a}	t _{ca}	t _{la}	t _{d m}	t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0

-	Ũ	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

a_3	$E_{\gamma m}$	$E_{\gamma a}$	$\Delta {\rm d_a}$	$\Delta {\rm d}_{\rm m}$	$\delta\epsilon_{ra}$	δε _{r m}		Ci
0.748	3	0	0	0	0	0	0	7.0E-02
-0.848	3	0	0	0	0	0	0	0.0E+00
0.957	7	0	0	0	0	0	0	-5.4E-02
-0.993	3	0	0	0	0	0	0	-9.6E-02
1.000)	0	0	0	0	0	0	-1.3E-01
()	1	0	0	0	0	0	-6.9E-01
()	0	1	0	0	0	0	7.2E-01
()	0	0	1	0	0	0	4.5E-02
()	0	0	0	1	0	0	-4.6E-02
()	0	0	0	0	1	1	0.0E+00
()	0	0	0	0	1	1	0.0E+00

a ₋₃	$E_{\gamma 2 m}$	a _{γ2 m}	$c_{\gamma 2 m}$	Ρ/Τ _{γ2 m}	$E_{\gamma 4 a}$	$P_{\gamma 4 a}$	P/T _{γ4 a}	$a_{\gamma 5 a}$	
0.74	8	0	0	0	0	0	0	0	0
-0.84	8	0	0	0	0	0	0	0	0
0.95	7	0	0	0	0	0	0	0	0
-0.99	3	0	0	0	0	0	0	0	0
1.00	D	0	0	0	0	0	0	0	0
	D	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	1	0
	0	0	0	0	0	1	0	0	0
	D	0	0	0	0	0	1	0	0
	D	0	0	0	1	0	0	1	0
	D	0	0	0	0	0	0	0	1
	D	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0

k _{0 Au} (m)	G_{tha}	G_{ea}	G_{thm}	G _{e m}	f	α	Q_{0a}	E _{ra}	
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	1	
---	---	---	---	---	---	---	---	---	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	

Covariance matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

	a ₁	a ₀	a_1	a_2	a ₋₃	E _{γ m}	$E_{\gamma a}$
a ₁	1.9E-03	-2.4E-03	7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00
a ₀	-2.4E-03	3.2E-03	-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00
a ₋₁	7.5E-04	-1.1E-03	3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00
a_2	-7.7E-05	1.1E-04	-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00
a_3	2.4E-06	-3.6E-06	1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00
$E_{\gamma m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08	0.0E+00
$E_{\gamma a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08
$\Delta d_{\rm a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\Delta d_{\rm m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\delta\epsilon_{ra}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
δε _{r m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	7.0E-02	0.0E+00	-5.4E-02	-9.6E-02	-1.3E-01	-6.9E-01	7.2E-01

$c_{\gamma 5 a}$	Ρ _{γ5 a}		Ci		a ₁	a ₀	a ₋₁
	0	0	-1.9E-01	a_1	1.9E-03	-2.4E-03	7.5E-04
	0	0	-1.3E-01	a ₀	-2.4E-03	3.2E-03	-1.1E-03
	0	0	-5.4E-02	a_1	7.5E-04	-1.1E-03	3.8E-04
	0	0	2.0E-01	a_2	-7.7E-05	1.1E-04	-4.3E-05
	0	0	1.4E+00	a_3	2.4E-06	-3.6E-06	1.4E-06
	0	0	9.7E-05	$E_{\gamma 2\ m}$	0.0E+00	0.0E+00	0.0E+00
	0	0	-1.4E-01	$a_{\gamma 2\ m}$	0.0E+00	0.0E+00	0.0E+00
	0	0	-1.4E-01	$C_{\gamma 2}$ m	0.0E+00	0.0E+00	0.0E+00
	0	0	7.4E-01	$P/T_{\gamma 2 m}$	0.0E+00	0.0E+00	0.0E+00
	0	0	-3.8E-05	$E_{\gamma4\ a}$	0.0E+00	0.0E+00	0.0E+00
	0	0	3.5E-01	$P_{\gamma 4 a}$	0.0E+00	0.0E+00	0.0E+00
	0	0	-1.8E-02	$P/T_{\gamma 4 a}$	0.0E+00	0.0E+00	0.0E+00
	0	0	1.0E-02	$a_{\gamma 5 a}$	0.0E+00	0.0E+00	0.0E+00
	1	0	1.0E-02	$C_{\gamma 5 a}$	0.0E+00	0.0E+00	0.0E+00
	0	1	-1.9E-02	$P_{\gamma 5 a}$	0.0E+00	0.0E+00	0.0E+00

Covariance matrix of $\text{COI}_{\text{m}}/\text{COI}_{\text{a}}$

c_i -1.9E-01 -1.3E-01 -5.4E-02

Q _{0 m}	E _{rm}	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	° COI _m / CO	I _a m _m	m _a	w _m	
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

0	0	0	0	0	0	0
1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	1	0
0	0	0	0	0	0	1
0	0	0	0	0	0	0

Δd_a	Δd_m	δε _{r a}		δε _{r m}	
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
8.3E-02	0.0E+00		0.0E+00		0.0E+00
0.0E+00	8.3E-02		0.0E+00		0.0E+00
0.0E+00	0.0E+00		3.0E-05		3.1E-05
0.0E+00	0.0E+00		3.1E-05		3.1E-05
4.5E-02	-4.6E-02		0.0E+00		0.0E+00

a_2	a_3	E _{γ2 m}	a _{γ2 m}	C _{γ2 m}	Ρ/Τ _{γ2 m}	E _{γ4 a}
-7.7E-05	2.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.1E-04	-3.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-4.3E-05	1.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4.9E-06	-1.7E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.7E-07	5.7E-09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	1.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-04	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-02
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-03	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.0E-01	1.4E+00	9.7E-05	-1.4E-01	-1.4E-01	7.4E-01	-3.8E-05

Covariance matrix of ρ_{a}

	с _і		ti	μ	
0	3.4E-15	t _i		3.0E+02	0.0E+00
0	-1.9E-09	μ		0.0E+00	2.5E-07
0	4.6E-15	t _{1/2 a}		0.0E+00	0.0E+00
0	-2.3E-16	t _{1/2 m}		0.0E+00	0.0E+00
0	7.0E-15	t _{d a}		0.0E+00	0.0E+00
0	4.7E-15	t _{ca}		0.0E+00	0.0E+00
0	-3.2E-14	t _{l a}		0.0E+00	0.0E+00
0	-1.6E-16	t _{d m}		0.0E+00	0.0E+00
0	-2.0E-12	t _{c m}		0.0E+00	0.0E+00
0	5.4E-11	t _{l m}		0.0E+00	0.0E+00
0	4.1E-12	n _{pa}		0.0E+00	0.0E+00
0	-2.8E-13	n _{p m}		0.0E+00	0.0E+00
0	-5.0E-04	k _{o Au} (a)		0.0E+00	0.0E+00
0	2.9E-08	k _{o Au} (m)		0.0E+00	0.0E+00
0	-3.6E-08	G _{th a}		0.0E+00	0.0E+00
0	-2.6E-09	G _{ea}		0.0E+00	0.0E+00
0	3.4E-08	G _{th m}		0.0E+00	0.0E+00
0	5.0E-09	G _{em}		0.0E+00	0.0E+00
0	-1.5E-10	f		0.0E+00	0.0E+00
0	-9.4E-09	CL		0.0E+00	0.0E+00
0	-2.9E-09	Q _{0 a}		0.0E+00	0.0E+00

0	-9.2E-14	E _{ra}	0.0E+00	0.0E+00
0	2.6E-09	Q _{0 m}	0.0E+00	0.0E+00
0	1.1E-12	E _{rm}	0.0E+00	0.0E+00
0	4.1E-08	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	0.0E+00	0.0E+00
0	4.5E-08	COI _m / COI _a	0.0E+00	0.0E+00
0	4.6E-06	m _m	0.0E+00	0.0E+00
0	-1.6E-07	m _a	0.0E+00	0.0E+00
0	8.4E-06	W _m	0.0E+00	0.0E+00
1	-3.9E-10	υ	0.0E+00	0.0E+00

c_i 3.4E-15 -1.9E-09

$P_{\gamma 4 a}$	P	/ Τ _{γ4 a}	a _{γ5 a}	C _{γ5 a}	$P_{\gamma 5 a}$
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	1.6E-03	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	1.3E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	4.7E-03	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-06
	3.5E-01	-1.8E-02	1.0E-02	1.0E-02	-1.9E-02

t _{1/2 a}	t _{1/2 m}	t _{d a}	t _{ca}	t _{la}	t _{d m}	
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	2.7E+05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	6.7E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.2E+03	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E+03
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4.6E-15	-2.3E-16	7.0E-15	4.7E-15	-3.2E-14	-1.6E-16

t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)	k _{o Au} (m)
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	3.4E+05	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	1.9E+05	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-13	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-05
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-2.0E-12	5.4E-11	4.1E-12	-2.8E-13	-5.0E-04	2.9E-08

1	~		
(-		
	-	÷	2

G _{e a}	G _{th m}	G _{em}	f	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-01
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-3.6E-08	-2.6E-09	3.4E-08	5.0E-09	-1.5E-10

CL.	Q _{0 a}	E _{ra}	Q _{0 m}	E _{rm}	ε _{p m}	^{geo} / ε _{pa} geo
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	4.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	9.5E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+	0.0E+00	2.3E+04	0.0E+00	0.0E+00	0.0E+00
0.0E+	0.0E+00	0.0E+00	3.6E-03	0.0E+00	0.0E+00
0.0E+	0.0E+00	0.0E+00	0.0E+00	4.8E+01	0.0E+00
0.0E+	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.5E-04
0.0E+	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-9.4E-	09 -2.9E-09	-9.2E-14	2.6E-09	1.1E-12	4.1E-08

COI _m / COI _a	m _m		m _a	W _m	υ
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	
2.6E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	
0.0E+00	2.5E-09	0.0E+00	0.0E+00	0.0E+00	
0.0E+00	0.0E+00	2.5E-09	0.0E+00	0.0E+00	
0.0E+00	0.0E+00	0.0E+00	2.1E-09	0.0E+00	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E+00	
4.5E-08	4.6E-06	-1.6E-07	8.4E-06	-3.9E-10	

Irradiation and γ -spectrometry

end irradiation	9/12/2017	2.46 PM
irradiation time / s	21600	

library	CSF.Lib
calib	OR50_source2016_geom_cont_12052017.Clb
sm type	CSF.Lib (ROI32 Analysis)

Nuclide	Channel	Er	nergy	Background
65Zn		4460.76	1115.5	44801
Co60		4691.96	1173.2	5220
	target	pr	oduct	
analite, a	⁶⁴ Zn	65	Zn	
monitor, m	⁵⁹ Co	60	Со	

Uncertainty budget of ρ_{a}

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
t _i		S	21600
μ		1	0.0445
t _{1/2 a}		S	21107520
	λ_{a}	s ⁻¹	3.3E-08
t _{1/2 m}		S	1.7E+08
	λ_{m}	s ⁻¹	4.2E-09
t _{d a}		S	2404405
t _{ca}		S	1292628
t _{la}		S	1264268
t _{d m}		S	3722775
t _{c m}		S	797
t _{l m}		S	740
	δ_{a}	1	1.022
	δ_{m}	1	1.077
	ξa	1	1.00098
	ξm	1	1.00319
n _{pa}		1	122602
n _{pm}		1	137487
k _{o Au} (a)		1	0.005720
k _{0 Au} (m)		1	1.3200
G _{th a}		1	1

G _{e a}		1		1
G _{th m}		1		1
G _{em}		1		1
f		1		15.60
α		1		-0.0360
Q_{0a}		1		1.91
E _{ra}		eV		2560
	$Q_{0a}(\alpha)$	1		2.41
Q _{0 m}		1		1.993
E _{rm}		eV		136.0
	$Q_{0 m}(\alpha)$	1		2.319
$\epsilon_{pm}^{\ \ geo}$ / $\epsilon_{pa}^{\ \ geo}$		1		0.9583
$\text{COI}_{\text{m}} / \text{COI}_{\text{a}}$		1		0.857
m _m		g		0.00847
m _a		g		0.24000
w _m		g g ⁻¹		0.004597
υ		$mg L^{-1}$		99.2
Y		[Y]	у	
$ ho_{a}$		g mL ⁻¹		2.220E-08

Uncertainty budget of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
a ₁		Mev-1	-0.472
a ₀			1 -3.229
a ₋₁		Mev	0.403
a_2		Mev2	-0.0320
a ₋₃		Mev3	0.000573
E _{γ m}		MeV	1.17320
$E_{\gamma a}$		MeV	1.11550
Δd_a		mm	0
Δd_{m}		mm	0
	e ₄	keV-4	-7.1E-11
	e ₃	keV-3	5.2E-08
	e ₂	keV-2	-1.4E-05
	e1	keV-1	1.8E-03
	e ₀		1 -4.5E-02
	d1	keV-1	5.6E-06

d _o		1	4.2E-02
$\delta\epsilon_{ra}$	mm⁻¹		0.048
δε _{rm}	mm⁻¹		0.048
Y	[Y]	У	
$\epsilon_{p m}^{geo} / \epsilon_{p a}^{geo}$	1		0.958

Uncertainty budget of COI_{m} / COI_{a}

Input Quantity	Quantity	Unit	Valu	ie
	X _i	[X _i]	x _i	
a.		Mey-1		-0 472
a ¹			1	-3 229
a 1		Mev	-	0.403
a 2		Mev2		-0.0320
a.,		Mev3		0.000573
	b ₁		1	-0.571
	b ₀		1	1.079
	C ₂		1	-1.625
	C ₁		1	6.678
	c _o		1	-7.006
E _{γ2 m}		keV		1332.5
a _{γ2 m}			1	1.000
C _{γ2 m}			1	1.000
P/T _{γ2 m}			1	0.197
	Y	[Y]	У	
	COI _m / COI _a		1	0.857

start counting	source file	WHM	ert % FW	Unce	Cnts/s	rea	Net area
10/10/2017	OR50_20171025_CSF_si	1.771	0.38	0.097	0.09	122602	
10/25/2017	OR50_20170925_Co_sa	1.798	0.32	5.919	185.91	137487	

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	$u_y^2(x_i)$		$x_i + u(x_i)$	$y(x_i+u(x_i))$
17	0.1%	3.2E-16	3.0E-29	0.0%	2.2E+04	2.2E-08
0.0005	1.1%	-1.1E-09	3.0E-25	0.0%	4.5E-02	2.2E-08
8640	0.0%	9.5E-16	6.7E-23	0.0%	2.1E+07	2.2E-08
1.3E-11	0.0%					
2.6E+04	0.0%	-1.3E-16	1.2E-23	0.0%	1.7E+08	2.2E-08
6.5E-13	0.0%					
35	0.0%	7.3E-16	6.4E-28	0.0%	2.4E+06	2.2E-08
0.3	0.0%	1.1E-15	1.0E-31	0.0%	1.3E+06	2.2E-08
0.3	0.0%	-1.8E-14	2.8E-29	0.0%	1.3E+06	2.2E-08
35	0.0%	-9.2E-17	1.0E-29	0.0%	3.7E+06	2.2E-08
0.3	0.0%	-1.2E-12	1.1E-25	0.0%	8.0E+02	2.2E-08
0.3	0.0%	3.1E-11	8.1E-23	0.0%	7.4E+02	2.2E-08
0.000	0.0%					
0.001	0.1%					
0.00001	0.0%					
0.00004	0.0%					
466	0.4%	1.8F-13	7.1F-21	1.2%	1.2F+05	2.2F-08
440	0.3%	-1 6F-13	5 OF-21	0.9%	1 4E+05	2 2E-08
0 000033	0.0%	-3 QF-UE	7 QF_21	1 3%	5 7F_03	2.2E 00
0.000023	0.4%	1 7E 00	7.5C-ZI	1 2%	1 25±00	2.2E-00
0.0055	0.4%	1.76-00	0.05.00	1.3%	1.05+00	2.22-00
0	0.0%	-1.9E-08	U.UE+00	0.0%	1.0E+00	2.2E-U8

0	0.0%	-3.0E-09	0.0E+00	0.0%	1.0E+00	2.2E-08
0	0.0%	1.9E-08	0.0E+00	0.0%	1.0E+00	2.2E-08
0	0.0%	2.9E-09	0.0E+00	0.0%	1.0E+00	2.2E-08
0.33	2.1%	6.6E-12	4.6E-24	0.0%	1.6E+01	2.2E-08
0.0064	17.8%	7.6E-09	2.4E-21	0.4%	-3.0E-02	2.2E-08
0.10	5.0%	-1.6E-09	2.4E-20	4.1%	2.0E+00	2.2E-08
256	10.0%	-3.4E-14	7.6E-23	0.0%	2.8E+03	2.2E-08
0.16	6.8%					
0.060	3.0%	1.5E-09	7.8E-21	1.3%	2.1E+00	2.2E-08
6.9	5.1%	6.1E-13	1.8E-23	0.0%	1.4E+02	2.2E-08
0.095	4.1%					
0.0189	2.0%	2.3E-08	1.9E-19	32.6%	9.8E-01	2.3E-08
0.017	2.0%	2.6E-08	1.9E-19	33.1%	8.7E-01	2.3E-08
0.00005	0.6%	2.6E-06	1.7E-20	2.9%	8.5E-03	2.2E-08
0.00005	0.0%	-9.2E-08	2.1E-23	0.0%	2.4E-01	2.2E-08
0.000046	1.0%	4.8E-06	4.9E-20	8.4%	4.6E-03	2.2E-08
1.2	1.2%	-2.2E-10	7.2E-20	12.3%	1.0E+02	2.2E-08

u_c(y)

u_{cr}(y)

Σ

7.7E-10	3.5%	100.0%

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	u ² _y (x _i)		$x_i + u(x_i)$	$y(x_i+u(x_i))$
0.043	9.2%	5.5E-02	4.3E-06	1.2%	-4.3E-01	9.6E-01
0.057	1.8%	0.0E+00	0.0E+00	0.0%	-3.2E+00	9.6E-01
0.020	4.8%	-4.2E-02	-1.2E-06	-0.3%	4.2E-01	9.6E-01
0.0022	6.9%	-7.4E-02	2.1E-07	0.1%	-3.0E-02	9.6E-01
0.000075	13.1%	-9.7E-02	-8.5E-09	0.0%	6.5E-04	9.6E-01
0.00012	0.0%	-7.0E-01	6.5E-09	0.0%	1.2E+00	9.6E-01
0.00012	0.0%	7.2E-01	6.9E-09	0.0%	1.1E+00	9.6E-01
0.29		4.6E-02	1.8E-04	49.2%	2.9E-01	9.7E-01
0.29		-4.6E-02	1.8E-04	49.9%	2.9E-01	9.4E-01
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					

0.000 0.0%

	0.019	2.0%			100.0%		
u _c (y) u		(γ)		Σ			
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.4E-02	9.6E-01
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.3E-02	9.6E-01
	0.0000	0.0%					

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	u ² _y (x _i)		$x_i + u(x_i)$	$y(x_i+u(x_i))$
0.043	9.2%	-0.1901	1.7E-05	5.9%	-4.3E-01	8.5E-01
0.057	1.8%	-0.1427	-1.4E-05	-4.9%	-3.2E+00	8.5E-01
0.020	4.8%	-0.1070	3.0E-06	1.0%	4.2E-01	8.6E-01
0.0022	6.9%	-0.0803	-2.2E-07	-0.1%	-3.0E-02	8.6E-01
0.000075	13.1%	-0.0603	5.0E-09	0.0%	6.5E-04	8.6E-01
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0.1	0.0%	0.0001	1.2E-10	0.0%	1.3E+03	8.6E-01
0.012	1.2%	-0.1426	2.7E-06	0.9%	1.0E+00	8.6E-01
0.012	1.2%	-0.1426	2.7E-06	0.9%	1.0E+00	8.6E-01
0.023	11.5%	0.7343	2.8E-04	96.2%	2.2E-01	8.7E-01
u _c (y)	u _r (y)			Σ		

0.017 2.0% 100.0%

t,	_ / s	t _I / s	t _{dead r} / %	t _d /	s s	t _c / t _{1/2}	t _d / t _{1/2}	
~~ · · ·	4000000	4064060		201				0

10:39 AM	1292628	1264268	2.2%	2404405	0.06	0.1	
4:52 PM	797	740	7.2%	3722775	0.00	0.0	

Correlation matrix of ρ_{a}

$x_i - u(x_i)$	$y(x_i - u(x_i))$						
			t _i	μ	t _{1/2 a}	t _{1/2 m}	
2.2E+04	2.2E-08	t _i		1	0	0	0
4.4E-02	2.2E-08	μ		0	1	0	0
2.1E+07	2.2E-08	t _{1/2 a}		0	0	1	0
		t _{1/2 m}		0	0	0	1
1.7E+08	2.2E-08	t _{d a}		0	0	0	0
		t _{ca}		0	0	0	0
2.4E+06	5 2.2E-08	t _{la}		0	0	0	0
1.3E+06	5 2.2E-08	t _{d m}		0	0	0	0
1.3E+06	5 2.2E-08	t _{c m}		0	0	0	0
3.7E+06	5 2.2E-08	t _{l m}		0	0	0	0
8.0E+02	2.2E-08	n _{pa}		0	0	0	0
7.4E+02	2.2E-08	n _{p m}		0	0	0	0
		k _{0 Au} (a)		0	0	0	0
		k _{0 Au} (m)		0	0	0	0
		G_{tha}		0	0	0	0
		G _{e a}		0	0	0	0
1.2E+05	2.2E-08	G _{th m}		0	0	0	0
1.4E+05	2.2E-08	G _{e m}		0	0	0	0
5.7E-03	2.2E-08	f		0	0	0	0
1.3E+00	2.2E-08	α		0	0	0	0
1.0E+00) 2.2E-08	Q_{0a}		0	0	0	0

1.0E+00	2.2E-08	E _{ra}	0	0	0	0
1.0E+00	2.2E-08	Q _{0 m}	0	0	0	0
1.0E+00	2.2E-08	Erm	0	0	0	0
1.5E+01	2.2E-08	ε_{pm}^{eo} / ε_{pa}	0	0	0	0
-4.2E-02	2.2E-08	COI_m / COI_a	0	0	0	0
1.8E+00	2.2E-08	m _m	0	0	0	0
2.3E+03	2.2E-08	m _a	0	0	0	0
		w _m	0	0	0	0
1.9E+00	2.2E-08	υ	0	0	0	0
1.3E+02	2.2E-08					
9 4F-01	2 2F-08					

J.TL UI	2.20 00
8.4E-01	2.2E-08
8.4E-03	2.2E-08
2.4E-01	2.2E-08
4.6E-03	2.2E-08
9.8E+01	2.2E-08

 $x_i \text{-}u(x_i) \qquad y(x_i \text{-}u(x_i))$

Correlation matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

			a_1		a ₀	a ₋₁	a ₋₂
-5.2E-01	9.6E-01	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	9.6E-01	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	9.6E-01	a ₋₁		0.884	-0.957	1.000	-0.984
-3.4E-02	9.6E-01	a ₋₂		-0.804	0.896	-0.984	1.000
5.0E-04	9.6E-01	a ₋₃		0.748	-0.848	0.957	-0.993
1.2E+00	9.6E-01	E _{γ m}		0	0	0	0
1.1E+00	9.6E-01	E _{γ a}		0	0	0	0
-2.9E-01	9.5E-01	Δd_{a}		0	0	0	0
-2.9E-01	9.7E-01	Δd_m		0	0	0	0
		δε _{r a}		0	0	0	0
		δε _{r m}		0	0	0	0

 x_i - $u(x_i)$ $y(x_i$ - $u(x_i))$

Correlation matrix of $\text{COI}_{\rm m}$ / $\text{COI}_{\rm a}$

			a_1	а	0	a ₋₁	a_2
-5.2E-01	8.7E-01	a ₁		1.000	-0.973	0.884	-0.804
-3.3E+00	8.7E-01	a ₀		-0.973	1.000	-0.957	0.896
3.8E-01	8.6E-01	a_1		0.884	-0.957	1.000	-0.984
-3.4E-02	8.6E-01	a ₋₂		-0.804	0.896	-0.984	1.000
5.0E-04	8.6E-01	a ₋₃		0.748	-0.848	0.957	-0.993
		$E_{\gamma 2\;m}$		0	0	0	0
		$a_{\gamma 2 m}$		0	0	0	0
		$C_{\gamma 2\ m}$		0	0	0	0
		$P/T_{\gamma 2 m}$		0	0	0	0

1.3E+03	8.6E-01
9.9E-01	8.6E-01
9.9E-01	8.6E-01
1.7E-01	8.4E-01

t _{d a}	t _{ca}	t _{la}	t _{d m}	t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} ((a)
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0

		-	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

a_3	$E_{\gamma m}$	$E_{\gamma a}$	$\Delta {\rm d_a}$	$\Delta {\rm d}_{\rm m}$	$\delta\epsilon_{ra}$	δε _{r m}	(Ci
0.748	3 0	() () (0	0	0	5.5E-02
-0.848	3 0	() () (0	0	0	0.0E+00
0.957	0	() () (0	0	0	-4.2E-02
-0.993	6 0	() () (D	0	0	-7.4E-02
1.000) 0	() () (0	0	0	-9.7E-02
() 1	. () () (D	0	0	-7.0E-01
() 0	1	1 () (0	0	0	7.2E-01
() 0	() 2	1 (D	0	0	4.6E-02
() 0	() () (1	0	0	-4.6E-02
() 0	() () (0	1	1	0.0E+00
() 0	() () (D	1	1	0.0E+00

Covariance

a ₋₃	$E_{\gamma 2 \ m}$	$a_{\gamma 2 m}$	$c_{\gamma 2 m}$	$P/T_{\gamma 2 m}$		Ci	
0.7	48	0	0	0	0	-1.9E-01	a_1
-0.8	348	0	0	0	0	-1.4E-01	a ₀
0.9	957	0	0	0	0	-1.1E-01	a_1
-0.9	93	0	0	0	0	-8.0E-02	a_2
1.0	000	0	0	0	0	-6.0E-02	a_3
	0	1	0	0	0	9.6E-05	$E_{\gamma 2} m$
	0	0	1	0	0	-1.4E-01	$a_{\gamma 2} m$
	0	0	0	1	0	-1.4E-01	$C_{\gamma 2} m$
	0	0	0	0	1	7.3E-01	$P/T_{\gamma 2 m}$

Ci

k _{0 Au} (m)	G_{tha}	G_{ea}	G_{thm}	G _{e m}	f	α	Q_{0a}	E _{ra}	
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0

0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Covariance matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

	a ₁	a ₀	a_1	a_2	a_3	$E_{\gamma m}$	E _{γ a}
a ₁	1.9E-03	-2.4E-03	7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00
a ₀	-2.4E-03	3.2E-03	-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00
a ₋₁	7.5E-04	-1.1E-03	3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00
a_2	-7.7E-05	1.1E-04	-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00
a_3	2.4E-06	-3.6E-06	1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00
$E_{\gamma m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08	0.0E+00
$E_{\gamma a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08
$\Delta {\rm d}_{\rm a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\Delta d_{\rm m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\delta\epsilon_{ra}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
δε _{r m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	5.5E-02	0.0E+00	-4.2E-02	-7.4E-02	-9.7E-02	-7.0E-01	7.2E-01

 $\mathbf{C}_{\mathbf{i}}$
matrix of COI_m/COI_a

a ₁	a ₀	a_1	a_2	a_3	$E_{\gamma 2} m$	$a_{\gamma 2 m}$	$C_{\gamma 2} m$	$P/T_{\gamma 2 m}$
1.9E-03	-2.4E-03	7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-2.4E-03	3.2E-03	-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
7.5E-04	-1.1E-03	3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-7.7E-05	1.1E-04	-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.4E-06	-3.6E-06	1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-02	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-04
-1.9E-01	-1.4E-01	-1.1E-01	-8.0E-02	-6.0E-02	9.6E-05	-1.4E-01	-1.4E-01	7.3E-01

Q _{0 m}	E _{rm}	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	° COI _m / CO	I _a m _m	m _a	w _m	
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

0	0	0	0	0	0	0
1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	1	0
0	0	0	0	0	0	1
0	0	0	0	0	0	0

Δd_a	Δd_m	δε _{r a}		δε _{r m}	
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
8.3E-02	0.0E+00		0.0E+00		0.0E+00
0.0E+00	8.3E-02		0.0E+00		0.0E+00
0.0E+00	0.0E+00		3.1E-05		3.1E-05
0.0E+00	0.0E+00		3.1E-05		3.1E-05
4.6E-02	-4.6E-02		0.0E+00		0.0E+00

Covariance matrix of ρ_{a}

	Ci		t _i	μ	
0	3.2E-16	ti		3.0E+02	0.0E+00
0	-1.1E-09	μ		0.0E+00	2.5E-07
0	9.5E-16	t _{1/2 a}		0.0E+00	0.0E+00
0	-1.3E-16	t _{1/2 m}		0.0E+00	0.0E+00
0	7.3E-16	t _{d a}		0.0E+00	0.0E+00
0	1.1E-15	t _{ca}		0.0E+00	0.0E+00
0	-1.8E-14	t _{la}		0.0E+00	0.0E+00
0	-9.2E-17	t _{d m}		0.0E+00	0.0E+00
0	-1.2E-12	t _{c m}		0.0E+00	0.0E+00
0	3.1E-11	t _{l m}		0.0E+00	0.0E+00
0	1.8E-13	n _{pa}		0.0E+00	0.0E+00
0	-1.6E-13	n _{p m}		0.0E+00	0.0E+00
0	-3.9E-06	k _{0 Au} (a)		0.0E+00	0.0E+00
0	1.7E-08	k _{o Au} (m)		0.0E+00	0.0E+00
0	-1.9E-08	G _{th a}		0.0E+00	0.0E+00
0	-3.0E-09	G _{ea}		0.0E+00	0.0E+00
0	1.9E-08	G _{th m}		0.0E+00	0.0E+00
0	2.9E-09	G _{e m}		0.0E+00	0.0E+00
0	6.6E-12	f		0.0E+00	0.0E+00
0	7.6E-09	CL		0.0E+00	0.0E+00
0	-1.6E-09	Q _{0 a}		0.0E+00	0.0E+00

0	-3.4E-14	E _{ra}	0.0E+00	0.0E+00
0	1.5E-09	Q _{0 m}	0.0E+00	0.0E+00
0	6.1E-13	Erm	0.0E+00	0.0E+00
0	2.3E-08	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	0.0E+00	0.0E+00
0	2.6E-08	COI _m / COI _a	0.0E+00	0.0E+00
0	2.6E-06	m _m	0.0E+00	0.0E+00
0	-9.2E-08	m _a	0.0E+00	0.0E+00
0	4.8E-06	W _m	0.0E+00	0.0E+00
1	-2.2E-10	υ	0.0E+00	0.0E+00

c_i 3.2E-16 -1.1E-09

t _{1/2 a}	t _{1/2 m}	t _{d a}	t _{ca}	t _{la}	t _{d m}	
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	7.5E+07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	6.7E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.2E+03	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E+03
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
9.5E-16	-1.3E-16	7.3E-16	1.1E-15	-1.8E-14	-9.2E-17

t _{c m}	t _{i m}	n _{pa}	n _{p m}	k _{o Au} (a)	k _{o Au} (m)
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	2.2E+05	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	1.9E+05	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-10	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-05
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.2E-12	2 3.1E-11	1.8E-13	-1.6E-13	-3.9E-06	1.7E-08

1	~		
(-		
	-	÷	2

G _{e a}	G _{th m}	G _{em}	f	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-01
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.9E-08	-3.0E-09	1.9E-08	2.9E-09	6.6E-12

CL	Q _{0 a}	E _{ra}	Q _{0 m}	Erm	ε _{p m}	^{geo} / ε _{pa} geo
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	4.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	9.1E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	6.6E+04	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	3.6E-03	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.8E+01	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E-04
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
7.6E-09	-1.6E-09	-3.4E-14	1.5E-09	6.1E-13	2.3E-08

COI _m / COI _a	m _m		m _a	W _m	υ
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2.9E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	2.5E-09	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	2.5E-09	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	2.1E-09	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E+00
2.6E-08	2.6E-06	-9.2E-08	4.8E-06	-2.2E-10

Irradiation and γ -spectrometry

end irradiation	9/12/2017	2.46 PM
irradiation time / s	21600	

library	CSF.Lib
calib	OR50_source2016_geom_cont_12052017.Clb
sm type	CSF.Lib (ROI32 Analysis)

Nuclide	Channel	E	nergy	Background
Co60		4692.95	1173.2	43993
Co60		4691.96	1173.2	5220
	target	р	roduct	
analite, a	⁵⁹ Co	60	Co	
monitor, m	⁵⁹ Co	60	°Co	

Uncertainty budget of ρ_{a}

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
t _i		S	21600
μ		1	0.0445
t _{1/2 a}		S	166345920
	λ_{a}	s ⁻¹	4.2E-09
t _{1/2 m}		S	1.7E+08
	λ_{m}	s ⁻¹	4.2E-09
t _{d a}		S	2404405
t _{ca}		S	1292628
t _{la}		S	1264268
t _{d m}		S	3722775
t _{c m}		S	797
t _{l m}		S	740
	δ_{a}	1	1.022
	δ_{m}	1	1.077
	ξa	1	1.00098
	ξm	1	1.00319
n _{pa}		1	4676
n _{p m}		1	137487
k _{o Au} (a)		1	1.3200
k _{o Au} (m)		1	1.3200
G _{th a}		1	1

G _{e a}		1		1
G _{th m}		1		1
G _{e m}		1		1
f		1		15.60
α		1		-0.0360
Q _{0 a}		1		1.993
E _{ra}		eV		136.0
	$Q_{0a}\left(lpha ight)$	1		2.32
Q _{0 m}		1		1.993
E _{rm}		eV		136.0
	$Q_{0m}(lpha)$	1		2.319
$\epsilon_{ m pm}^{ m geo}$ / $\epsilon_{ m pa}^{ m geo}$		1		1.0000
$\text{COI}_{\text{m}} / \text{COI}_{\text{a}}$		1		1.000
m _m		g		0.00847
m _a		g		0.24000
w _m		g g ⁻¹	0	.004597
υ		mg L^{-1}		99.2
Υ		[Y]	У	
$ ho_{a}$		g mL⁻¹	3	3.24E-11

Uncertainty budget of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

Input Quantity	Quantity	Unit	Value
X _i	X _i	[X _i]	x _i
a ₁		Mev-1	-0.472
a ₀			1 -3.229
a ₋₁		Mev	0.403
a_2		Mev2	-0.0320
a ₋₃		Mev3	0.000573
$E_{\gamma m}$		MeV	1.17320
$E_{\gamma a}$		MeV	1.17320
Δd_a		mm	0
Δd_m		mm	0
	e ₄	keV-4	-7.1E-11
	e ₃	keV-3	5.2E-08
	e ₂	keV-2	-1.4E-05
	e1	keV-1	1.8E-03
	e ₀		1 -4.5E-02
	d_1	keV-1	5.6E-06

d ₀		1	4.2E-02
$\delta \epsilon_{ra}$	mm ⁻¹		0.048
δε _{rm}	mm⁻¹		0.048
Y	[Y]	У	
$\varepsilon_{p m}^{geo} / \varepsilon_{p a}^{geo}$	1		1.000

Uncertainty budget of COI_{m} / COI_{a}

Input Quantity	Quantity	Unit	Valu	le
	X _i	[X _i]	x _i	
a ₁		Mev-1		-0.472
a ₀			1	-3.229
a ₋₁		Mev		0.403
a ₋₂		Mev2		-0.0320
a_3		Mev3		0.000573
	b ₁		1	-0.571
	b ₀		1	1.079
	C ₂		1	-1.625
	c ₁		1	6.678
	c ₀		1	-7.006
$E_{\gamma 2 m}$		keV		1332.5
a _{γ2 m}			1	1.000
$C_{\gamma 2 m}$			1	1.000
Ρ/Τ _{γ2 m}			1	0.197
E _{y2 a}		keV		1332.5
a _{γ2 a}			1	1.000
$C_{\gamma 2 a}$			1	1.000
P/T _{γ2 a}			1	0.197
	Y	[Y]	У	
	COI _m / COI _a		1	1.000

Net area	Cnts/s	Uncert %	FWHM	source file	e start counting
4	676 0.00	9.3	6 1.63	OR50_20	171025_CSF_s; 10/10/2017
137	487 185.91	.9 0.3	1.79	OR50_20	170925_Co_sa 10/25/2017

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	ensit coeff
u(x _i)	u _r (x _i)	C _i	$u_y^2(x_i)$		x _i +u(x _i)	$y(x_i+u(x_i))$
17	0.1%	1.9E-28	1.0E-53	0.0%	2.2E+04	3.2E-11
0.0005	5 1.1%	-1.6E-12	6.5E-31	0.0%	4.5E-02	3.2E-11
25920	0.0%	1.9E-19	7.1E-32	0.0%	1.7E+08	3.2E-11
6.5E-13	3 0.0%					
2.6E+04	1 0.0%	-1.9E-19	-7.0E-32	0.0%	1.7E+08	3.2E-11
6.5E-13	3 0.0%					
35	5 0.0%	1.4E-19	2.2E-35	0.0%	2.4E+06	3.2E-11
0.3	3 0.0%	1.2E-18	1.1E-37	0.0%	1.3E+06	3.2E-11
0.3	3 0.0%	-2.7E-17	6.0E-35	0.0%	1.3E+06	3.2E-11
35	0.0%	-1.4E-19	2.2E-35	0.0%	3.7E+06	3.2E-11
0.3	3 0.0%	-1.7E-15	2.4E-31	0.0%	8.0E+02	3.2E-11
0.3	3 0.0%	4.6E-14	1.7E-28	0.0%	7.4E+02	3.2E-11
0.000	0.0%					
0.001	0.1%					
0.00001	0.0%					
0.00004	0.0%					
438	3 9.4%	6.9E-15	9.2E-24	92.8%	5.1E+03	3.5E-11
44(0.3%	-2.4F-16	1.1F-26	0.1%	1.4F+05	3.2F-11
0.0053	0.3%	-2 5F-11	2 7F-31	0.0%	1 3F+00	3 2F-11
0.005	0.4%	2.52 11 2 5F-11	-2 7F-21	0.0%	1.3E+00	3.2E 11
0.005	0.0%	_2.5C-11	0 0F±00	0.0%	1.0E±00	3.3E-11

0	0.0%	-4.2E-12	0.0E+00	0.0%	1.0E+00	3.2E-11
0	0.0%	2.8E-11	0.0E+00	0.0%	1.0E+00	3.2E-11
0	0.0%	4.2E-12	0.0E+00	0.0%	1.0E+00	3.2E-11
0.33	2.1%	0.0E+00	0.0E+00	0.0%	1.6E+01	3.2E-11
0.0064	17.8%	0.0E+00	0.0E+00	0.0%	-3.0E-02	3.2E-11
0.060	3.0%	-2.2E-12	2.6E-31	0.0%	2.1E+00	3.2E-11
6.9	5.1%	-8.9E-16	3.6E-34	0.0%	1.4E+02	3.2E-11
0.10	4.1%					
0.060	3.0%	2.2E-12	-2.6E-31	0.0%	2.1E+00	3.3E-11
6.9	5.1%	8.9E-16	-3.6E-34	0.0%	1.4E+02	3.2E-11
0.095	4.1%					
0.0197	2.0%	3.2E-11	4.1E-25	4.1%	1.0E+00	3.3E-11
0.000	0.0%	3.2E-11	9.5E-30	0.0%	1.0E+00	3.2E-11
0.00005	0.6%	3.8E-09	3.7E-26	0.4%	8.5E-03	3.3E-11
0.00005	0.0%	-1.4E-10	4.6E-29	0.0%	2.4E-01	3.2E-11
0.000046	1.0%	7.0E-09	1.1E-25	1.1%	4.6E-03	3.3E-11
1.2	1.2%	-3.3E-13	1.5E-25	1.6%	1.0E+02	3.2E-11

u_c(y)

u_{cr}(y)

Σ

3.1E-12	9.7%	100.0%
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Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	C _i	u ² _y (x _i)		$x_i + u(x_i)$	$y(x_i+u(x_i))$
0.043	9.2%	0.0E+00	0.0E+00	0.0%	-4.3E-01	1.0E+00
0.057	1.8%	0.0E+00	0.0E+00	0.0%	-3.2E+00	1.0E+00
0.020	4.8%	0.0E+00	0.0E+00	0.0%	4.2E-01	1.0E+00
0.0022	6.9%	0.0E+00	0.0E+00	0.0%	-3.0E-02	1.0E+00
0.000075	13.1%	0.0E+00	0.0E+00	0.0%	6.5E-04	1.0E+00
0.00012	0.0%	-7.3E-01	7.0E-09	0.0%	1.2E+00	1.0E+00
0.00012	0.0%	7.3E-01	7.0E-09	0.0%	1.2E+00	1.0E+00
0.29		4.8E-02	1.9E-04	50.0%	2.9E-01	1.0E+00
0.29		-4.8E-02	1.9E-04	50.0%	2.9E-01	9.9E-01
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					
0.0000	0.0%					

	0.020	2.0%			100.0%		
u _c (y)	U _{c r}	(y)		Σ			
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.4E-02	1.0E+00
	0.006	11.5%	0.0E+00	0.0E+00	0.0%	5.4E-02	1.0E+00
	0.0000	0.0%					

Std unc	Rel std unc	Sensit coeff	Variance y	Index	Input for se	nsit coeff
u(x _i)	u _r (x _i)	c _i	$u_y^2(x_i)$		$x_i + u(x_i)$	$y(x_i+u(x_i))$
0.043	9.2%	0.0000	0.0E+00	0.0%	-4.3E-01	1.0E+00
0.057	1.8%	0.0000	0.0E+00	0.0%	-3.2E+00	1.0E+00
0.020	4.8%	0.0000	0.0E+00	0.0%	4.2E-01	1.0E+00
0.0022	6.9%	0.0000	0.0E+00	0.0%	-3.0E-02	1.0E+00
0.000075	13.1%	0.0000	0.0E+00	0.0%	6.5E-04	1.0E+00
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0	0.0%					
0.1	0.0%	0.0001	-3.0E-19	0.0%	1.3E+03	1.0E+00
0.012	1.2%	-0.1663	-1.4E-11	-0.1%	1.0E+00	1.0E+00
0.012	1.2%	-0.1663	-1.4E-11	-0.1%	1.0E+00	1.0E+00
0.023	11.5%	0.8564	-1.9E-06	-20439%	2.2E-01	1.0E+00
0.12	0.0%	-0.0001	3.0E-19	0.0%	1.3E+03	1.0E+00
0.012	1.2%	0.1663	1.4E-11	0.1%	1.0E+00	1.0E+00
0.012	1.2%	0.1663	1.4E-11	0.1%	1.0E+00	1.0E+00
0.023	11.5%	-0.8606	1.9E-06	20539%	2.2E-01	9.8E-01

u_c(y) u_r(y)

Σ

0.000 0.0%

100.0%

t	. _c / s	t _I / s	t _{dead r} / %	t _d / s	t _c / t _{1/2}	t _d / t _{1/2}
10·39 ΔM	1292628	1264268	2 20/	2/0//05	0.01	0

10.59 Alvi	1292020	1204200	2.270	2404405	0.01	0.0
4:52 PM	797	740	7.2%	3722775	0.00	0.0

Correlation matrix of ρ_{a}

$x_i - u(x_i)$	$y(x_i - u(x_i))$						
			t _i	μ	t _{1/2 a}	t _{1/2 m}	
2.2E+04	3.2E-11	t _i		1	0	0	0
4.4E-02	3.2E-11	μ		0	1	0	0
1.7E+08	3.2E-11	t _{1/2 a}		0	0	1	1
		t _{1/2 m}		0	0	1	1
1.7E+08	3.2E-11	t _{d a}		0	0	0	0
		t _{c a}		0	0	0	0
2.4E+06	5 3.2E-11	t _{la}		0	0	0	0
1.3E+06	3.2E-11	t _{d m}		0	0	0	0
1.3E+06	5 3.2E-11	t _{c m}		0	0	0	0
3.7E+06	3.2E-11	t _{l m}		0	0	0	0
8.0E+02	3.2E-11	n _{pa}		0	0	0	0
7.4E+02	3.2E-11	n _{p m}		0	0	0	0
		k _{o Au} (a)		0	0	0	0
		k _{0 Au} (m)		0	0	0	0
		${\sf G}_{\sf tha}$		0	0	0	0
		G _{e a}		0	0	0	0
4.2E+03	2.9E-11	G_{thm}		0	0	0	0
1.4E+05	3.3E-11	G _{em}		0	0	0	0
1.3E+00) 3.3E-11	f		0	0	0	0
1.3E+00) 3.2E-11	α		0	0	0	0
1.0E+00) 3.2E-11	Q_{0a}		0	0	0	0

3.2E-11	E _{ra}	0	0	0	0
3.2E-11	Q _{0 m}	0	0	0	0
3.2E-11	Erm	0	0	0	0
3.2E-11	ϵ_{pm}^{eo} / ϵ_{pa}^{i}	0	0	0	0
3.2E-11	COI_m / COI_a	0	0	0	0
3.3E-11	m _m	0	0	0	0
3.2E-11	m _a	0	0	0	0
	w _m	0	0	0	0
3.2E-11	υ	0	0	0	0
3.2E-11					
3.2E-11					
	3.2E-11 3.2E-11 3.2E-11 3.2E-11 3.2E-11 3.2E-11 3.2E-11 3.2E-11 3.2E-11	3.2E-11 E_{ra} 3.2E-11 Q_{0m} 3.2E-11 E_{rm} 3.2E-11 ε_{pm} 3.2E-11 COI_m / COI_a 3.3E-11 m_m 3.2E-11 w_m 3.2E-11 v	3.2E-11 E_{ra} 0 3.2E-11 Q_{0m} 0 3.2E-11 E_{rm} 0 3.2E-11 $\varepsilon_{pm}^{geo} / \varepsilon_{pa}^{-1}$ 0 3.2E-11 COI_m / COI_a 0 3.3E-11 m_m 0 3.2E-11 w_m 0 3.2E-11 w_m 0 3.2E-11 v 0	3.2E-11 E_{ra} 0 0 3.2E-11 Q_{0m} 0 0 3.2E-11 E_{rm} 0 0 3.2E-11 ε_{pm} 0 0 3.2E-11 ε_{pm} 0 0 3.2E-11 COI_m / COI_a 0 0 3.2E-11 m_m 0 0 3.2E-11 m_m 0 0 3.2E-11 m_m 0 0 3.2E-11 v_m 0 0 3.2E-11 v 0 0	3.2E-11 E_{ra} 0 0 0 3.2E-11 Q_{0m} 0 0 0 3.2E-11 E_{rm} 0 0 0 3.2E-11 $\varepsilon_{pm}^{geo}/\varepsilon_{pa}^{-1}$ 0 0 0 3.2E-11 COI_m/COI_a 0 0 0 3.2E-11 m_m 0 0 0 3.2E-11 m_m 0 0 0 3.2E-11 m_m 0 0 0 3.2E-11 m_a 0 0 0 3.2E-11 υ 1 υ 1 3.2E-11 υ 0 0 0 3.2E-11 υ υ υ υ 3.2E-11 υ υ υ υ σ υ υ

1.0E+00	3.2E-11
8.4E-03	3.2E-11
2.4E-01	3.2E-11
4.6E-03	3.2E-11
9.8E+01	3.3E-11

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

				a_1		a ₀		a ₋₁	i	a ₋₂	
-5.2E-01	1.0E+00	;	a ₁		1.000	-C	.973	0.8	84		-0.804
-3.3E+00	1.0E+00	i	a ₀		-0.973	1	.000	-0.9	57		0.896
3.8E-01	1.0E+00	;	a ₋₁		0.884	-C	.957	1.00	00		-0.984
-3.4E-02	1.0E+00	i	a ₋₂		-0.804	C	.896	-0.98	84		1.000
5.0E-04	1.0E+00	;	a ₋₃		0.748	-C	.848	0.9	57		-0.993
1.2E+00	1.0E+00		E _{γ m}		0		0		0		0
1.2E+00	1.0E+00		E _{γa}		0		0		0		0
-2.9E-01	9.9E-01		Δd_a		0		0		0		0
-2.9E-01	1.0E+00		Δd_m		0		0		0		0
		i	δε _{r a}		0		0		0		0
		i	δε _{r m}		0		0		0		0

 x_i -u(x_i) $y(x_i$ -u(x_i))

Correlation matrix of $\ensuremath{\mathsf{COI}_{\mathsf{m}}}\xspace$ / $\ensuremath{\mathsf{COI}_{\mathsf{m}}}\xspace$ / $\ensuremath{\mathsf{COI}_{\mathsf{m}}}\xspace$

			a	1 1	a ₀	a_1	a ₋₂
-5.2E-01	1.0E+00	ā	a ₁	1.000	-0.973	0.884	-0.804
-3.3E+00	1.0E+00	ā	a ₀	-0.973	1.000	-0.957	0.896
3.8E-01	1.0E+00	ā	9 ₋₁	0.884	-0.957	1.000	-0.984
-3.4E-02	1.0E+00	ā	a ₋₂	-0.804	0.896	-0.984	1.000
5.0E-04	1.0E+00	ā	1 ₋₃	0.748	-0.848	0.957	-0.993
		E	γ2 m	0	0	0	0
		ā	β γ2 m	0	0	0	0
		C	γ2 m	0	0	0	0
		F	Ρ/Τ _{γ2 m}	0	0	0	0
		E	γ2 a	0	0	0	0
1.3E+03	1.0E+00	ā	9 γ2 a	0	0	0	0
9.9E-01	1.0E+00	C	γ2 a	0	0	0	0
9.9E-01	1.0E+00	F	P/T _{γ2 a}	0	0	0	0
1.7E-01	9.8E-01						
1.3E+03	1.0E+00						
9.9E-01	1.0E+00						

9.9E-01 1.0E+00

1.7E-01 1.0E+00

t _{d a}	t _{ca}	t _{la}	t _{d m}	t _{c m}	t _{l m}	n _{pa}	n _{p m}	k _{o Au} (a)
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0

-	Ũ	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

a ₋₃	$E_{\gamma m}$	$E_{\gamma a}$	Δd_{a}	Δd_{m}	$\delta\epsilon_{ra}$	$\delta\epsilon_{rm}$		Ci
0.74	8	0	0	0	0	0	0	0.0E+00
-0.84	8	0	0	0	0	0	0	0.0E+00
0.95	7	0	0	0	0	0	0	0.0E+00
-0.99	3	0	0	0	0	0	0	0.0E+00
1.00	D	0	0	0	0	0	0	0.0E+00
	0	1	0	0	0	0	0	-7.3E-01
	0	0	1	0	0	0	0	7.3E-01
	D	0	0	1	0	0	0	4.8E-02
	D	0	0	0	1	0	0	-4.8E-02
	0	0	0	0	0	1	1	0.0E+00
	D	0	0	0	0	1	1	0.0E+00

a ₋₃	E _{γ2 m}	$a_{\gamma 2 m}$	$C_{\gamma 2 m}$	P/T _{γ2 m}	$E_{\gamma 2 a}$	$a_{\gamma 2 a}$	$C_{\gamma 2 a}$	$P/T_{\gamma 2 a}$	
0.748	3 0	0	0	C) (0	0	0	0
-0.848	3 0	0	0	C) (0	0	0	0
0.957	7 0	0	0	C) (0	0	0	0
-0.993	3 0	0	0	C) (0	0	0	0
1.000) 0	0 0	0	C) (0	0	0	0
() 1	. 0	0	C)	1	0	0	0
() 0	1	. 0	C) (0	1 (0	0
() 0	0) 1	C) (0	0	1	0
() 0	0	0	1	L (0	0	0	1
() 1	. 0	0	C)	1	0	0	0
() 0	1	. 0	C) (0	1	0	0
() 0	0) 1	C) (0	0	1	0
() 0	0	0	1	L (0	0	0	1

k _{o Au} (m)	G_{tha}	G _{e a}	G _{th m}	G _{e m}	f	α	Q_{0a}	Era	
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0
	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	0	1	0	0
	0	0	0	0	0	0	0	1	0

0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Covariance matrix of $\epsilon_{p\,m}^{~~geo}$ / $\epsilon_{p\,a}^{~~geo}$

	a ₁	a ₀	a_1	a_2	a_3	$E_{\gamma m}$	$E_{\gamma a}$
a ₁	1.9E-03	-2.4E-03	7.5E-04	-7.7E-05	2.4E-06	0.0E+00	0.0E+00
a ₀	-2.4E-03	3.2E-03	-1.1E-03	1.1E-04	-3.6E-06	0.0E+00	0.0E+00
a ₋₁	7.5E-04	-1.1E-03	3.8E-04	-4.3E-05	1.4E-06	0.0E+00	0.0E+00
a_2	-7.7E-05	1.1E-04	-4.3E-05	4.9E-06	-1.7E-07	0.0E+00	0.0E+00
a_3	2.4E-06	-3.6E-06	1.4E-06	-1.7E-07	5.7E-09	0.0E+00	0.0E+00
$E_{\gamma m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08	0.0E+00
$E_{\gamma a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-08
$\Delta {\rm d}_{\rm a}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\Delta d_{\rm m}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
$\delta\epsilon_{ra}$	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
δε _{r m}	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	-7.3E-01	7.3E-01

Covariance matrix of $\text{COI}_{\text{m}}/\text{COI}_{\text{a}}$

Ci		a ₁	a ₀	a ₋₁			
0.0E+00	a ₁	1.9E-03	-2.4E-03	7.5E-04			
0.0E+00	a ₀	-2.4E-03	3.2E-03	-1.1E-03			
0.0E+00	a_1	7.5E-04	-1.1E-03	3.8E-04			
0.0E+00	a_2	-7.7E-05	1.1E-04	-4.3E-05			
0.0E+00	a_3	2.4E-06	-3.6E-06	1.4E-06			
1.1E-04	$E_{\gamma 2} m$	0.0E+00	0.0E+00	0.0E+00			
-1.7E-01	$a_{\gamma 2 m}$	0.0E+00	0.0E+00	0.0E+00			
-1.7E-01	$C_{\gamma 2}$ m	0.0E+00	0.0E+00	0.0E+00			
8.6E-01	$P/T_{\gamma 2 m}$	0.0E+00	0.0E+00	0.0E+00			
-1.1E-04	$E_{\gamma 2}$ a	0.0E+00	0.0E+00	0.0E+00			
1.7E-01	$a_{\gamma 2 a}$	0.0E+00	0.0E+00	0.0E+00			
1.7E-01	$C_{\gamma 2}$ a	0.0E+00	0.0E+00	0.0E+00			
-8.6E-01	$P/T_{\gamma 2 a}$	0.0E+00	0.0E+00	0.0E+00			
	Ci	0.0E+00	0.0E+00	0.0E+00			
Q _{0 m}	E _{rm}	$\epsilon_{ m pm}^{ m geo}$ / $\epsilon_{ m pa}^{ m geo}$	° COI _m / CO	l _a m _m	m _a	w _m	
-------------------------	-----------------	---	-------------------------	-------------------------------	----------------	----------------	---
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	1	0	0	0	0	0	0

0	1	0	0	0	0	0
1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	1	0
0	0	0	0	0	0	1
0	0	0	0	0	0	0

Δd_a	Δd_m	δε _{r a}		δε _{r m}	
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
0.0E+00	0.0E+00		0.0E+00		0.0E+00
8.3E-02	0.0E+00		0.0E+00		0.0E+00
0.0E+00	8.3E-02		0.0E+00		0.0E+00
0.0E+00	0.0E+00		3.1E-05		3.1E-05
0.0E+00	0.0E+00		3.1E-05		3.1E-05
4.8E-02	-4.8E-02		0.0E+00		0.0E+00

a_2	a ₋₃	E _{γ2 m}	$a_{\gamma 2 m}$	C _{γ2 m}	Ρ/Τ _{γ2 m}	E _{γ2 a}
-7.7E-05	2.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.1E-04	-3.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-4.3E-05	1.4E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4.9E-06	-1.7E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.7E-07	5.7E-09	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	1.3E-02	0.0E+00	0.0E+00	0.0E+00	1.3E-02
0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-04	0.0E+00
0.0E+00	0.0E+00	1.3E-02	0.0E+00	0.0E+00	0.0E+00	1.3E-02
0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-04	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-04	0.0E+00
0.0E+00	0.0E+00	1.1E-04	-1.7E-01	-1.7E-01	8.6E-01	-1.1E-04

Covariance matrix of ρ_{a}

	C _i		t _i	μ	
0	1.9E-28	t _i		3.0E+02	0.0E+00
0	-1.6E-12	μ		0.0E+00	2.5E-07
0	1.9E-19	t _{1/2 a}		0.0E+00	0.0E+00
0	-1.9E-19	t _{1/2 m}		0.0E+00	0.0E+00
0	1.4E-19	t _{d a}		0.0E+00	0.0E+00
0	1.2E-18	t _{c a}		0.0E+00	0.0E+00
0	-2.7E-17	t _{l a}		0.0E+00	0.0E+00
0	-1.4E-19	t _{d m}		0.0E+00	0.0E+00
0	-1.7E-15	t _{c m}		0.0E+00	0.0E+00
0	4.6E-14	t _{l m}		0.0E+00	0.0E+00
0	6.9E-15	n _{pa}		0.0E+00	0.0E+00
0	-2.4E-16	n _{p m}		0.0E+00	0.0E+00
0	-2.5E-11	k _{o Au} (a)		0.0E+00	0.0E+00
0	2.5E-11	k _{o Au} (m)		0.0E+00	0.0E+00
0	-2.8E-11	G_{tha}		0.0E+00	0.0E+00
0	-4.2E-12	G _{ea}		0.0E+00	0.0E+00
0	2.8E-11	G _{th m}		0.0E+00	0.0E+00
0	4.2E-12	G _{em}		0.0E+00	0.0E+00
0	0.0E+00	f		0.0E+00	0.0E+00
0	0.0E+00	CL		0.0E+00	0.0E+00
0	-2.2E-12	Q _{0 a}		0.0E+00	0.0E+00

0	-8.9E-16	E _{ra}	0.0E+00	0.0E+00
0	2.2E-12	Q _{0 m}	0.0E+00	0.0E+00
0	8.9E-16	Erm	0.0E+00	0.0E+00
0	3.2E-11	ϵ_{pm}^{geo} / ϵ_{pa}^{geo}	0.0E+00	0.0E+00
0	3.2E-11	COI _m / COI _a	0.0E+00	0.0E+00
0	3.8E-09	m _m	0.0E+00	0.0E+00
0	-1.4E-10	m _a	0.0E+00	0.0E+00
0	7.0E-09	W _m	0.0E+00	0.0E+00
1	-3.3E-13	υ	0.0E+00	0.0E+00

c_i 1.9E-28 -1.6E-12

$a_{\gamma 2 a}$		$C_{\gamma 2}$ a		$P/T_{\gamma 2 a}$
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	0.0E+00
	0.0E+00		0.0E+00	0.0E+00
	1.3E-04		0.0E+00	0.0E+00
	0.0E+00		1.3E-04	0.0E+00
	0.0E+00		0.0E+00	5.2E-04
	0.0E+00		0.0E+00	0.0E+00
	1.3E-04		0.0E+00	0.0E+00
	0.0E+00		1.3E-04	0.0E+00
	0.0E+00		0.0E+00	5.2E-04
	1.7E-01		1.7E-01	-8.6E-01

t _{1/2 a}	t _{1/2 m}	t _{d a}	t _{ca}	t _{la}	t _{d m}	
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	6.7E+08	6.7E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	6.7E+08	6.7E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.2E+03	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.3E-02	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E+03
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1.9E-19	-1.9E-19	1.4E-19	1.2E-18	-2.7E-17	-1.4E-19

t _{c m}	t _{i m}	n _{pa}	n _{p m}	k _{o Au} (a)	k _{o Au} (m)
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	1.9E+05	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	1.9E+05	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-05	2.8E-05
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-05	2.8E-05
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-1.7E-15	4.6E-14	6.9E-15	-2.4E-16	-2.5E-11	2.5E-11

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	-	÷	2

G _{e a}	G _{th m}	G _{e m}	f	
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-01
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
-2.8E-11	-4.2E-12	2.8E-11	4.2E-12	0.0E+00

CL	Q _{0 a}	E _{ra}	Q _{0 m}	E _{rm}	ε _{p m}	^{geo} / ε _{pa} geo
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	4.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	0.0E+00	3.6E-03	0.0E+00	3.6E-03	0.0E+00	0.0E+00

0.0E+00	0.0E+00	4.8E+01	0.0E+00	4.8E+01	0.0E+00
0.0E+00	3.6E-03	0.0E+00	3.6E-03	0.0E+00	0.0E+00
0.0E+00	0.0E+00	4.8E+01	0.0E+00	4.8E+01	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.9E-04
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	-2.2E-12	-8.9E-16	2.2E-12	8.9E-16	3.2E-11

COI _m / COI _a	m _m		m _a	W _m	υ
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00		0.0E+00	0.0E+00	0.0E+00	0.0E+00

0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
9.1E-09	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00	2.5E-09	0.0E+00	0.0E+00	0.0E+00
0.0E+00	0.0E+00	2.5E-09	0.0E+00	0.0E+00
0.0E+00	0.0E+00	0.0E+00	2.1E-09	0.0E+00
0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E+00
3.2E-11	3.8E-09	-1.4E-10	7.0E-09	-3.3E-13

Title page

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4 Title: An uncertainty spreadsheet for the k_0 -standardisation method in Neutron Activation

5 Analysis

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An uncertainty spreadsheet for the k0-standardisation method in Neutron Activation Analysis

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21 Abstract

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22 This paper focuses on the use of the spreadsheet technique to set up the uncertainty budget 23 for the k_0 -standardisation method in Neutron Activation Analysis. The adopted 24 measurement model included most of presently recognized error sources and was written 25 to limit the covariances between input quantities. The calculations were implemented in a 26 worksheet file and tested in a multi-elemental analysis of a biological material. Besides, it 27 was demonstrated that the k_0 -standardisation turns to the relative-standardisation when the 28 monitor element corresponds to the analyte element. The developed worksheet is available 29 and suitable for the analysis of other materials in different experimental conditions.

30 Keywords

 k_0 -standardisation method, uncertainty budget, spreadsheet technique, correlated input quantities, cerebrospinal fluid

33 Introduction

In 1995, a guide was published by EURACHEM/CITAC [1] to illustrate the use in chemistry measurements of the general rules outlined in the Guide to the Expression of

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Uncertainty in Measurement (GUM) [2] for the evaluation and expression of uncertainty.
Afterwards, since specific applications in nuclear chemistry measurements were missing
in the guide, practical examples for the most common nuclear analytical techniques were
included in a report of the International Atomic Energy Agency (IAEA) [3].

40 The Neutron Activation Analysis (NAA) was addressed in the IAEA report, as regards the 41 existing standardisation methods, i.e. the relative- and k_0 -NAA. A detailed list of sources 42 of error were identified and grouped in four categories: i) preparation of samples, ii) 43 neutron irradiation, iii) *y*-spectrometry measurements and iv) radiochemical separation, if 44 executed. Two uncertainty budgets were given as examples for the relative-NAA, the first 45 dealing with vanadium in coal fly ash by Instrumental NAA (INAA) and the latter with 46 manganese in animal freeze dried blood by Radiochemical NAA (RNAA). Only one 47 example for the k_0 -NAA was cited, with a reference to the (preliminary) evaluation 48 performed by de Corte [4].

49 Next, several studies focused on the k_0 -NAA. Robouch et al [5] suggested the use of the 50 spreadsheet technique developed by Kragten [6] and recommended a general equation to 51 express the uncertainty of the results. Younes et al [7] showed that the sensitivity 52 coefficients, computed by finite difference approximations in the spreadsheet technique, 53 could also be expressed in analytical form. In fact, subsequent works were all based on 54 analytical expressions of the sensitivity coefficients [8, 9].

To date, the most comprehensive examples of uncertainty budgets for k_0 -NAA were reported in [9] and concerned the determination of Au, Cr, Rb and Sb in compressed cellulose pellets. The covariances between input quantities, in practice always neglected in the previously available literature, were to some extent considered. However, values and expressions of correlation and sensitivity coefficients were omitted.

In this study, we adopted a measurement equation modeling most of the acknowledged sources of error and written to limit the covariances. Due to the complexity of the resulting functional relationship, we used the spreadsheet technique and the matrix formalism to propagate the uncertainties, including the outstanding correlations. The formulae were implemented and tested for the determination of trace elements in a biological material.

Details on the neutron activation experiment as well as on the characterization of the detection system are here presented to assign estimates, uncertainties and correlation coefficients of the input quantities. Lastly, the uncertainty budgets are briefly discussed to point out the main contributors to the combined uncertainties of the results.

69 Model

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The theoretical basis of k_0 -NAA is well established and extensively reported in literature. Simonits et al. proposed the original idea in 1975 [10] following a preliminary study carried out by Girardi et al. [11]. In 1987, de Corte published the most comprehensive development of the method [4], including references to previous papers focused on definitions and assumptions of the standardisation. Here, the basic concepts are briefly recalled to term the input quantities of the measurement model.

The formalism underlying the method is based on a rather simple description of the reaction rate per target nuclide, *R*, following the Høgdahl convention [12] in the case of a (target) nuclide having a $1/E^{1/2}$ dependence of the (n, γ) cross section function, $\sigma(E)$, versus the neutron energy, *E*.

According to the convention, the neutron spectrum is divided in the sub- and epi-cadmium regions, respectively below and above the cadmium cut-off energy fixed to 0.55 eV. The fission component is neglected under the hypothesis that the corresponding contribution to *R* is small. Accordingly:

 $R = G_{\rm th} \Phi_{\rm s} \sigma_0 + G_{\rm e} \Phi_{\rm e} I_0(\alpha), \tag{1}$

where $\Phi_{\rm s}$ and $\Phi_{\rm e}$ are the (conventional) sub- and epi-cadmium neutron fluxes, $G_{\rm th}$ and $G_{\rm e}$ are correction factors accounting for the thermal and epithermal neutron self-shielding, σ_0 is the thermal cross section, and $I_0(\alpha)$ is the resonance integral for a $1/E^{1+\alpha}$ neutron spectrum in the epi-cadmium region.

The knowledge of the time dependence of the amount of produced radionuclide during and
after activation combined to the counting of the emitted *p*-photons links the number of

91 target nuclides in a sample, $N_{\rm t}$, to the number of counts in the full-energy peak of the 92 collected γ -spectrum, $n_{\rm p}$, via R.

With the exception of branching activation and mother-daughter decay, and neglecting burn-up effects, the relation between N_t and n_p is:

95
$$R N_{t} \varepsilon_{p}^{\text{geo}} P_{\gamma} = \frac{\lambda n_{p} \left(\delta \xi / \text{COI}\right)}{\left(1 - e^{-\lambda t_{i}}\right) e^{-\lambda t_{d}} \left(1 - e^{-\lambda t_{c}}\right)}, \qquad (2)$$

where R N_t is the total reaction rate, $\varepsilon_p^{\text{geo}}$ is the full-energy γ -peak detection efficiency for 96 the actual position and geometry of the sample, P_{γ} is the absolute emission probability of 97 the γ -photons, t_c and t_l are the counting and live times of the detection system, t_i is the 98 99 irradiation time, t_d is the decay time after irradiation, COI is the true-coincidence correction factor, $\lambda = \ln(2) / t_{1/2}$ is the decay constant of the produced radionuclide, given 100 its half-life $t_{1/2}$, $\delta = t_c/t_l$ is the dead time correction factor and $\xi = e^{\mu(1-t_l/t_c)}$ is the 101 excess counting loss correction factor, given the excess counting loss constant of the 102 103 detection system, μ , defined in [13].

104 In the case that the (target) nuclide is an isotope of an element in a *m* mass sample, N_t can 105 be expressed as:

$$N_{\rm t} = \frac{w \, m \, x \, N_{\rm A}}{M},\tag{3}$$

107 where *x* is the abundance of the isotope, N_A is the Avogadro constant, and *w* and *M* are the 108 mass fraction and molar mass of the element in the sample, respectively.

109 From eqs. (1), (2) and (3), it follows:

110
$$\frac{\sigma_0 P_{\gamma} x N_A}{M} = \frac{\lambda n_p \left(\delta \xi / \text{COI}\right)}{\left(1 - e^{-\lambda t_i}\right) e^{-\lambda t_i} \left(1 - e^{-\lambda t_c}\right) \varepsilon_p^{\text{geo}}} \frac{1}{m w} \frac{1}{\phi_s \left(G_{\text{th}} + \frac{G_e Q_0(\alpha)}{f}\right)}, \tag{4}$$

111 where $Q_0(\alpha) = I_0(\alpha)/\sigma_0$ and $f = \Phi_s/\Phi_e$. The $Q_0(\alpha)$ value is obtained by applying the 112 formula $Q_0(\alpha) = (Q_0 - 0.429)\overline{E}_r^{-\alpha} + 0.429/[0.55^{\alpha}(1+2\alpha)]$, where $Q_0 = I_0/\sigma_0$ is the

- 113 ratio of the resonance integral (for a 1/E neutron spectrum in the epi-cadmium region) to
- 114 the thermal cross section and \overline{E}_r is the effective resonance energy of the target nuclide.
- 115 It is worth remarking that the parameters on the left-hand side of (4) are independent of the
- 116 experimental conditions of irradiation and γ -counting. In fact, the product $\sigma_0 P_{\gamma} N_A$ is a
- 117 constant quantity and the ratio x/M depends on the isotopic composition.
- 118 The k_0 -NAA measurement model is derived from the application of (4) to the element to
- be quantified, i.e. the analyte, and to an element used as a monitor of the of the neutronfluence rate.
- 121 The following equation holds under the assumption that analyte and monitor are exposed 122 to the same (constant) values of Φ_s and Φ_e during the irradiation:

123
$$w_{a} = \frac{\frac{\lambda n_{p} \delta \xi}{\left(1 - e^{-\lambda t_{i}}\right)e^{-\lambda t_{d}}\left(1 - e^{-\lambda t_{c}}\right)}}{\frac{\lambda n_{p} \delta \xi}{\left(1 - e^{-\lambda t_{i}}\right)e^{-\lambda t_{d}}\left(1 - e^{-\lambda t_{c}}\right)}} \frac{k_{0 Au}(m)}{k_{0 Au}(a)} \frac{\left(G_{th m} + \frac{G_{e m} Q_{0 m}(\alpha)}{f}\right)}{\left(G_{th a} + \frac{G_{e a} Q_{0 a}(\alpha)}{f}\right)} \frac{\varepsilon_{p m}^{geo}}{\varepsilon_{p a}^{geo}} \frac{\text{COI}_{m}}{\text{COI}_{a}} \frac{m_{m}}{m_{a}} w_{m}, \qquad (5)$$

124 where the parameters $k_{0 Au}(m) = \frac{M_{Au} \sigma_{0 m} P_{\gamma m} x_m}{M_m \sigma_{0 Au} P_{\gamma Au} x_{Au}}$ and $k_{0 Au}(a) = \frac{M_{Au} \sigma_{0 a} P_{\gamma a} x_a}{M_a \sigma_{0 Au} P_{\gamma Au} x_{Au}}$ are the 125 so-called k_0 factors; subscripts a and m refer to the analyte and to the monitor, respectively. 126 The k_0 values have been experimentally determined for the most important (n, γ) reactions 127 and γ -photons energies with respect to the 411 keV γ -photons emitted by ¹⁹⁸Au produced 128 from ¹⁹⁷Au via (n, γ) reaction. A compilation of the recommended $k_0 Au$, Q_0 and \overline{E}_r values 129 can be found in [14].

130 **Experimental**

To exemplify the use of the equation model (5), we measured a lyophilized sample of cerebrospinal fluid (CSF). The experiment was intended to set up the uncertainty budget and not to reach the minimum uncertainty. The results were given in terms of mass 134 concentrations, $\rho_a = w_a/v$, where v is the factor used to convert the mass of lyophilized 135 CSF to the volume of reconstituted CSF.

136 Preparation of the samples

Ten vials of lyophilized CSF, each one corresponding to 3 mL volumes of reconstituted CSF, were purchased. The content of every single vial was moved to an acid-cleaned 8 mL cut polyethylene (PE) vial and sealed. The mass to volume conversion factor, v =99.2(12) mL g⁻¹, was obtained as the ratio of 3 mL to the average of the (ten) mass differences between the filled and empty (washed and dried out) vials. Here and hereafter, unless otherwise specified, the brackets refer to the standard uncertainty and apply to the last digits.

One sample, about 28 mm length, of an Al-0.46%Co wire (Reactor Experiment, 99.9313% purity, 0.38 mm diameter) was used as a Co monitor. The weighed mass, $m_{\rm m} =$ 8.47(5) mg, was sealed in one PE micro-tube. A conservative 1% relative standard uncertainty was assigned to the declared Co mass fraction value, $w_{\rm m} = 4.597(46) \times$ 10^{-3} g g⁻¹.

149 Neutron irradiation

150 The neutron irradiation lasted $t_i = 6.000(5)$ h and was performed in the 250 kW TRIGA 151 Mark II reactor at the Laboratory of Applied Nuclear Energy (LENA) of the University of 152 Pavia. The quoted uncertainty corresponds to a uniform probability distribution assigned 153 to the t_i value and having a 30 s half-width.

The vial containing the lyophilized CSF sample and the micro-tube containing the Al-Co wire were put in one PE container used for irradiation and located in the central channel (CC) of the reactor; the neutron flux parameters at CC, f = 15.6(3) and $\alpha = -0.036(6)$, were recently measured [15]. The position of the lyophilized CSF sample and of the Al-Co wire during the irradiation is shown in Figure 1.



159

160 161

Fig 1 Position of the lyophilized CSF sample and of the Al-Co wire during the irradiation. Dimensions in mm

162 *Gamma spectrometry*

163 After irradiation, the lyophilized CSF sample was moved from its vial to a new 10 mL PE 164 vial and weighed; the mass, m_a , was found to be 240.00(5) mg, corresponding to 23.81(28) 165 mL volume of reconstituted CSF in the case of negligible effect due to humidity. The 166 relative loss of sample was about 20%, probably due to the lyophilized CSF residuals in 167 the vials. The Al-Co wire was removed from its micro-tube, placed in a new 10 mL vial 168 and dissolved using a few drops of nitric and hydrochloric acid (1:1) solution. After 169 complete digestion, water was added to obtain the same volume as the lyophilized CSF 170 sample.

171 The γ -spectra were recorded with a high purity germanium (HPGe) detector, ORTEC 172 GEM50P4-83 (relative efficiency 50%, resolution 1.90 keV at 1332 keV) inside a low-173 background graded shield. The detector was connected to a digital signal processor ORTEC 174 DSPEC 502 and the data were collected and processed using the ORTEC Gamma Vision 175 software (version 6.08). The acquisition was performed in extended live-time correction 176 mode using the Gedcke-Hale method with pulse pile-up rejection in automatic set 177 threshold; the excess counting loss constant of the detection system, $\mu = 0.0445(5)$, was 178 recently measured [13].

- 179 The position of the lyophilized CSF and dissolved Al-Co wire samples with respect to the
- 180 detector end-cap is shown in Figure 2a.



Fig 2 Position of the lyophilized CSF and dissolved Al-Co wire samples (a), and of the
 disk source (b) with respect to the detector end-cap. Dimensions in mm

183 The collection of the γ -spectrum emitted by the CSF sample started at $t_{d a} =$ 184 667.890(10) h, lasted $t_{c a} = 359.0633(1)$ h and ended with a live time $t_{l a} =$ 185 351.1856(1) h. The dissolved Al-Co monitor was successively measured. The collection 186 of the γ -spectrum started at $t_{d m} = 1034.10(1)$ h, lasted $t_{c m} = 797.0(3)$ s and ended with 187 a live time $t_{l m} = 740.0(3)$ s. The quoted uncertainties correspond to uniform probability 188 distributions assigned to the t_d , t_c and t_l values and having 60 s, 0.5 s and 0.5 s half-widths, 189 respectively.

190 **Detection system characterization**

191 Full-energy γ -peak detection efficiency

192 The $\varepsilon_{p}^{\text{geo}}$ values in (5) depend on the actual position and geometry of the measured samples.

193 The dependence is strengthened when extensive samples are measured close to the detector194 end-cap, as in this case.

In principle, the reconstruction of the $\varepsilon_p^{\text{geo}}$ versus the γ -energy, E_{γ} , might be performed by measuring the γ -emissions of an extensive standard source having the same shape as the analyte and monitor sample and located at the same position with respect to the detector end-cap. In addition, the material of the source should have the same major elemental composition as the monitor and analyte sample in order to mimic the γ self-absorption.

Actually, a more flexible procedure based on a computational technique coupled to a quasipoint standard source measured at large source-detector distance is commonly adopted [16]; geometries and major elemental composition of sample and layers between the Ge crystal and sample are required.

As an approximated alternative, we recorded two γ -spectra with a disk standard source positioned at the vertical ends of the measured extended samples, as shown in Figure 2b. The efficiency of the (virtual) extensive source, $\varepsilon_p^{\text{ext}}$, was estimated by the average of the disk efficiencies in positions 1 and 2, $\varepsilon_{p \text{ pos1}}^{\text{disk}}$ and $\varepsilon_{p \text{ pos2}}^{\text{disk}}$, respectively.

The coincidence free γ -emissions selected to reconstruct the efficiency curves were ²⁴¹Am 59.54 keV, ¹⁰⁹Cd 88.03 keV, ⁵⁷Co 122.06 keV, ¹³⁹Ce 165.86 keV, ¹¹³Sn 391.70 keV, ¹³⁷Cs 661.66 keV, ⁵⁴Mn 834.85 keV and ⁶⁵Zn 1115.54 keV.

211 The $\varepsilon_{p pos1}^{disk}$, $\varepsilon_{p pos2}^{disk}$ and ε_{p}^{ext} versus E_{γ} data were fitted by the equation model

212
$$\ln \varepsilon_{\rm p} = a_1 E_{\gamma} + a_0 + a_{-1} E_{\gamma}^{-1} + a_{-2} E_{\gamma}^{-2} + a_{-3} E_{\gamma}^{-3}, \tag{6}$$

where a_1 , a_0 , a_{-1} , a_{-2} and a_{-3} are the fitting parameters. Best values, including uncertainties and correlation matrix, were calculated using the algorithm implemented in the OriginPro 2017.

216 The values obtained with the $\varepsilon_p^{\text{ext}}$ data were $a_1 = -4.72(43) \times 10^{-1} \text{ MeV}^{-1}$, $a_0 =$

217
$$-3.229(57)$$
, $a_{-1} = 4.03(20) \times 10^{-1}$ MeV, $a_{-2} = -3.20(22) \times 10^{-2}$ MeV², $a_{-3} = -3.20(22) \times 10^{-2}$

218 $-5.73(75) \times 10^{-4}$ MeV³; the corresponding correlation matrix is shown in Table 1.

219	Table	1	Correlation	matrix	of	the	fitting
220	parame	ters	obtained with	the e ^{ext}	data	1	

	a_1	a_0	a_{-1}	a_{-2}	a_{-3}
a_1	1.000	-0.973	0.884	-0.804	0.748
a_0	-0.973	1.000	-0.957	0.896	-0.848
<i>a</i> ₋₁	0.884	-0.957	1.000	-0.984	0.957
a_{-2}	-0.804	0.896	-0.984	1.000	-0.993
<i>a</i> ₋₃	0.748	-0.848	0.957	-0.993	1.000

221 The $\varepsilon_{p \text{ pos1}}^{\text{disk}}$, $\varepsilon_{p \text{ pos2}}^{\text{disk}}$ and $\varepsilon_{p}^{\text{ext}}$ versus E_{γ} curves and the $\varepsilon_{p}^{\text{ext}}$ residuals are plotted in Figure 3a

and Figure 3b, respectively. The error bars indicate a 95% confidence interval due to fitting,

taking into account the correlations.





Possible differences in counting positions of the measured samples with respect to the(virtual) extensive source were considered according to:

228
$$\frac{\varepsilon_{\rm p\,m}^{\rm geo}}{\varepsilon_{\rm p\,a}^{\rm geo}} = \frac{\varepsilon_{\rm p\,m}^{\rm ext}}{\varepsilon_{\rm p\,a}^{\rm ext}} \frac{(1 - \delta\varepsilon_{\rm r\,m}\,\Delta d_{\rm m})}{(1 - \delta\varepsilon_{\rm r\,a}\,\Delta d_{\rm a})},\tag{7}$$

where $\Delta d_{\rm m}$ and $\Delta d_{\rm a}$ are the vertical position differences between the dissolved Al-Co wire and the (virtual) extensive source and between the lyophilized CSF sample and the (virtual) extensive source, respectively, and $\delta \varepsilon_{\rm r,m}$ and $\delta \varepsilon_{\rm r,a}$ are the relative variations of the detection efficiency per unit of vertical position for the monitor and the analyte, respectively.

233 The $\delta \varepsilon_{\rm r}$ values were obtained from the ratio of $(\varepsilon_{\rm p\,pos2}^{\rm disk} - \varepsilon_{\rm p\,pos1}^{\rm disk})/\varepsilon_{\rm p}^{\rm ext}$ to the difference 234 between the vertical positions 1 and 2, i.e. 11 mm, and plotted versus E_{γ} in Figure 4.



235

Fig 4 $\delta \varepsilon_{\rm r}$ versus E_{γ} curve. The vertical dashed line at about 240 keV splits the curve in two different regions

The data were fitted by $\delta \varepsilon_{\rm r} = d_0 + d_1 E_{\gamma}$ and $\delta \varepsilon_{\rm r} = e_0 + e_1 E_{\gamma} + e_2 E_{\gamma}^2 + e_3 E_{\gamma}^3 + e_4 E_{\gamma}^4$, for γ -energies above and below the 240 keV threshold, respectively. The resulting values were $e_4 = -7.10 \times 10^{-11} \text{ keV}^{-4}$, $e_3 = 5.19 \times 10^{-8} \text{ keV}^{-3}$, $e_2 = -1.43 \times 10^{-5} \text{ keV}^{-2}$, $e_1 = 1.78 \times 10^{-3} \text{ keV}^{-1}$, $e_0 = -4.46 \times 10^{-2}$ and $d_1 = 5.56 \times 10^{-6} \text{ keV}^{-1}$, $d_0 = 4.17 \times 10^{-2}$.

243 Peak-to-total ratio

True-coincidence occurs when two or more cascading γ -photons are emitted with negligible time delay by a radionuclide. The effect becomes significant when samples are measured close to the detector end-cap.

247 The number of counts collected in the full-energy γ -peak, $n_{\rm p}$, is adjusted using the 248 correction factor

249
$$\text{COI} = (1 - L_{\gamma})(1 + S_{\gamma}),$$
 (8)

where L_{γ} and S_{γ} are the overall probabilities for coincidence loss and summing, respectively [4].

The formulae adopted to calculate L_{γ} and S_{γ} values depend on the cascade schemes and include several nuclear parameters, the most important ones being the absolute emission probability of the γ -photons, P_{γ} , the branching ratio, a_{γ} , and the total internal conversion coefficient, α_{t} . In addition, $\varepsilon_{p}^{\text{geo}}$ and the peak-to-total ratio, P/T, of the detection system are required.

E.g., the probability for coincidence loss of γ_A and γ_B in the case of $\gamma_A \rightarrow \gamma_B$ decay scheme is

259
$$L_{\gamma_{\rm A}} = a_{\gamma_{\rm B}} c_{\gamma_{\rm B}} \frac{\varepsilon_{\rm p\,\gamma_{\rm B}}^{\rm geo}}{(P/T)_{\gamma_{\rm B}}} \text{ and } L_{\gamma_{\rm B}} = \frac{P_{\gamma_{\rm A}}}{P_{\gamma_{\rm B}}} a_{\gamma_{\rm B}} c_{\gamma_{\rm B}} \frac{\varepsilon_{\rm p\,\gamma_{\rm A}}^{\rm geo}}{(P/T)_{\gamma_{\rm A}}}, \tag{9}$$

260 respectively, where $c_{\gamma} = 1/(1 + \alpha_{t\gamma})$, whereas the probability for coincidence summing 261 of γ_A with the $\gamma_B \rightarrow \gamma_C$ decay scheme is

262
$$S_{\gamma_{\rm A}} = \frac{P_{\gamma_{\rm B}}}{P_{\gamma_{\rm A}}} a_{\gamma_{\rm C}} c_{\gamma_{\rm C}} \frac{\varepsilon_{\rm p \gamma_{\rm B}}^{\rm geo} \varepsilon_{\rm p \gamma_{\rm C}}^{\rm geo}}{\varepsilon_{\rm p \gamma_{\rm A}}^{\rm geo}}.$$
 (10)

A compilation of the nuclear parameters values and the cascade schemes concerning the radionuclides generally used in NAA are reported in [4].

265 Similar to $\varepsilon_p^{\text{geo}}$, the *P*/*T* ratio versus E_{γ} data can be ideally obtained from γ -spectra of 266 coincidence free radionuclides embedded in extensive sources having the same material

and shape as the analyte and monitor sample and located at the same position with respect to the detector end-cap. In practice, since the P/T ratio is above all depending on the position and to a smaller extent on the composition and geometry of the samples, use of quasi-point γ -sources might be accepted.

In this study, we used five γ -emissions, i.e. ²⁴¹Am 59.54 keV, ¹⁷⁰Tm 84.25 keV, ²⁰³Hg 272 279.19 keV, ¹³⁷Cs 661.66 keV and ⁶⁵Zn 1115.54 keV, to reconstruct the *P/T* ratio curve.

The data were fitted by $\log P/T = b_0 + b_1 \log E_{\gamma}$ and $\log P/T = c_0 + c_1 \log E_{\gamma} + c_2 (\log E_{\gamma})^2$, for γ -energies above and below the 170 keV threshold, respectively. To avoid a discontinuity, the first derivative with respect to $\log E_{\gamma}$ of the latter equation model at 170 keV was imposed to be the b_1 value. The resulting values were $b_1 = -0.571$, $b_0 =$ 1.079, $c_2 = -1.625$, $c_1 = 6.678$ and $c_0 = -7.006$.

278 The *P*/*T* ratio versus E_{γ} curve is plotted in Figure 5.



279

Fig 5 P/T ratio versus E_{γ} curve. The vertical dashed line at about 170 keV splits the curve in two different regions

282 **Results and discussion**

283 The analysis of the γ -spectrum of the lyophilized CSF sample pointed out ²³³Pa, ⁵¹Cr, ¹³¹Ba, 284 ¹²⁴Sb, ⁴⁶Sc, ⁸⁶Rb, ⁵⁹Fe, ⁶⁵Zn and ⁶⁰Co γ -emissions produced by neutron capture reactions from ²³²Th, ⁵⁰Cr, ¹³⁰Ba, ¹²³Sb, ⁴⁵Sc, ⁸⁵Rb, ⁵⁸Fe, ⁶⁴Zn and ⁵⁹Co. The mass concentrations of the corresponding elements were quantified using the ⁶⁰Co γ -emission of the monitor.

The number of counts collected in the γ -peaks were evaluated with the algorithm implemented in the ROI32 analysis engine of the Gamma Vision software. The γ -peak energies and n_p values of the detected radionuclides in the CSF sample and monitor are reported in Table 2; the uncertainty (conservatively) assigned to E_{γ} corresponds to a uniform distribution with 0.2 keV half-width whereas the n_p uncertainty is due to counting statistics, including background.

294

Table 2 γ -peak energies and corresponding number of counts of the detected radionuclides

Radionuclide	E_{γ} / keV	<i>n</i> _p / 1
233 Pa ^(CSF)	311.90(12)	$1.017(24) \times 10^5$
$^{51}Cr^{(CSF)}$	320.10(12)	$5.26(15) \times 10^4$
$^{131}Ba^{(CSF)}$	496.30(12)	$5.08(12) \times 10^4$
124 Sb ^(CSF)	1691.00(12)	$2.47(21) \times 10^2$
46 Sc ^(CSF)	889.30(12)	$1.3070(80) \times 10^5$
⁸⁶ Rb ^(CSF)	1077.00(12)	$4.56(44) \times 10^3$
⁵⁹ Fe ^(CSF)	1099.30(12)	$9.46(59) \times 10^3$
⁶⁵ Zn ^(CSF)	1115.50(12)	$1.2260(47) \times 10^5$
⁶⁰ Co ^(CSF)	1173.20(12)	$4.68(44) \times 10^3$
⁶⁰ Co ^(monitor)	1173.20(12)	$1.3749(44) \times 10^{5}$

The full-energy γ -peak detection efficiencies ratio, $\varepsilon_{p m}^{geo}/\varepsilon_{p a}^{geo}$, was computed according to 295 (7) using a_1 , a_0 , a_{-1} , a_{-2} , a_{-3} and d_1 , d_0 , e_0 , e_1 , e_2 , e_3 , e_4 to obtain $\varepsilon_{p\,m}^{ext}/\varepsilon_{p\,a}^{ext}$ and $\delta\varepsilon_r$, 296 respectively, as a function of E_{γ} . The uncertainty of the $\varepsilon_{p m}^{\text{ext}}/\varepsilon_{p a}^{\text{ext}}$ was evaluated taking into 297 account uncertainties and correlations of the fitting parameters whereas a uniform 298 299 probability distribution with a (conservative) 20% relative half-width was directly assigned 300 to the $\delta \varepsilon_r$ value. In addition, it was assumed that the vertical position of the samples was within ±0.5 mm with respect to the (virtual) extensive γ -source; accordingly, $\Delta d_{\rm m} = \Delta d_{\rm a} =$ 301 302 0.00(29) mm, the quoted uncertainty corresponding to a uniform probability distribution 303 having 0.5 mm half-width.

²⁹³

The true-coincidence correction factors ratio, $\text{COI}_{\text{m}}/\text{COI}_{\text{a}}$, was obtained via (8) using b_0 , b_1 , c_0 , c_1 and c_2 to determine P/T as a function of E_{γ} . A uniform probability distribution with a (conservative) 20% relative half-width was directly assigned to the P/T value. The effect due to possible differences in counting positions was neglected; specifically, $\varepsilon_p^{\text{geo}}$ was used instead of $\varepsilon_p^{\text{ext}}$ in (9) and (10). Cascade schemes, notations and P_{γ} , a_{γ} , α_t values proposed in [4] were adopted with uncertainties corresponding to uniform probability distributions having 0.0002, 0.02 and 0.02 half-widths, respectively.

311 A list of neutron capture reactions and $t_{1/2}$, $k_{0 Au}$, Q_0 , \overline{E}_r values recommended in the k_0

database [14] and used in this study are reported in Table 3 for reader's convenience.

Reaction	<i>t</i> _{1/2} / h	k _{0 Au} / 1	Q ₀ / 1	$\overline{E}_{ m r}$ / eV
232 Th(n, γ) 233 Pa	647.280(48)	$2.520(13) \times 10^{-2}$	11.50(41)	54.40(49)
${}^{50}\mathrm{Cr}(\mathbf{n},\gamma){}^{51}\mathrm{Cr}$	664.800(58)	$2.620(13) \times 10^{-3}$	0.53(11)	$753(83) \times 10^{1}$
130 Ba(n, γ) 131 Ba	276.0(14)	$6.480(13) \times 10^{-5}$	24.8(50)	69.9(35)
123 Sb(n, γ) 124 Sb	1444.80(72)	$1.410(16) \times 10^{-2}$	28.8(11)	28.2(18)
45 Sc(n, γ) 46 Sc	2011.92(48)	1.2200(49)	0.430(86)	$513(87) \times 10^{1}$
85 Rb(n, γ) 86 Rb	447.12(48)	$7.650(77) \times 10^{-4}$	14.80(37)	839(50)
${}^{58}\text{Fe}(n,\gamma){}^{59}\text{Fe}$	1068.00(14)	$7.770(39) \times 10^{-5}$	0.975(10)	$64(15) \times 10^{1}$
64 Zn(n, γ) 65 Zn	5863.2(24)	$5.720(23) \times 10^{-3}$	1.91(10)	$256(26) \times 10^{1}$
$^{59}Co(n, \gamma)^{60}Co$	46207.2(72)	1.3200(53)	1.993(60)	136.0(69)

313 **Table 3** Neutron capture reactions and adopted $t_{1/2}$, $k_{0 Au}$, Q_0 , \overline{E}_r values.

Values and uncertainties assigned to t_i , $t_{d a}$, $t_{c a}$, $t_{l a}$, $t_{c m}$, $t_{l m}$, μ , f, α , m_a , m_m , w_m and ν are given in the section 3. The thermal and epithermal neutron self-shielding of the lyophilized CSF sample and of the dissolved (and diluted) Co monitor were considered insignificant. Accordingly, $G_{th m} = G_{th a} = G_{e m} = G_{e a} = 1.000$ with negligible uncertainty.

319 Uncertainty budget

320 The spreadsheet technique was applied to set up the uncertainty budget of the analyte mass

321 concentration, ρ_a , via the measurement model (5).
322 The input quantities for ρ_a were t_i , μ , $t_{1/2 a}$, $t_{1/2 m}$, $t_{d a}$, $t_{c a}$, $t_{l a}$, $t_{d m}$, $t_{c m}$, $t_{l m}$, $n_{p a}$, $n_{p m}$,

- 323 $k_{0 \text{Au}}(a), k_{0 \text{Au}}(m), G_{\text{th a}}, G_{\text{e a}}, G_{\text{th m}}, G_{\text{e m}}, f, \alpha, Q_{0 a}, \overline{E}_{r a}, Q_{0 m}, \overline{E}_{r m}, \varepsilon_{p m}^{\text{geo}}/\varepsilon_{p a}^{\text{geo}}, \text{COI}_{m}/\text{COI}_{a},$
- 324 $m_{\rm m}, m_{\rm a}, w_{\rm m}$ and v. The intermediate quantities $\lambda_{\rm a}, \lambda_{\rm m}, \delta_{\rm a}, \delta_{\rm m}, \xi_{\rm a}, \xi_{\rm m}, Q_{0 \rm a}(\alpha)$ and $Q_{0 \rm m}(\alpha)$
- 325 were calculated for information.

For simplicity, the $\varepsilon_{p\,n}^{geo}/\varepsilon_{p\,a}^{geo}$ and COI_m/COI_a values and uncertainties were computed 326 327 separately via the measurement models (7) and (8), respectively. The input quantities for $\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}$ were $a_1, a_0, a_{-1}, a_{-2}, a_{-3}, E_{v\,m}, E_{v\,a}, \Delta d_a, \Delta d_m, \delta \varepsilon_{r\,a}$ and $\delta \varepsilon_{r\,m}$ while the input 328 quantities for COI_m/COI_a were $a_1, a_0, a_{-1}, a_{-2}, a_{-3}$ and additional parameters depending 329 on the cascade scheme, e.g. E_{γ} , a_{γ} , c_{γ} , P/T and P_{γ} either for the monitor and for the analyte. 330 The quantities e_4 , e_3 , e_2 , e_1 , e_0 , d_1 and d_0 used to compute $\delta \varepsilon_r$ and the quantities b_1 , b_0 , 331 c_2 , c_1 and c_0 used to compute P/T were given for information. The (small) correlation 332 333 effect due to the shared parameters a_1, a_0, a_{-1}, a_{-2} and a_{-3} was neglected.

334 The formulae were implemented in a MS excel file [17] consisting of nine worksheets, one 335 for each quantified analyte. A single worksheet included four sections. Irradiation time, day and time of the irradiation end, day and time of the γ -counting start, outputs of the 336 Gamma Vision software, target nuclide and produced radionuclide were given in the first 337 section, called "Irradiation and y-spectrometry". Values, standard uncertainties and 338 339 correlation coefficients of the input quantities were added in the main section, called "Uncertainty budget of ρ_a ", with the exception of the $\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}$ and COI_m/COI_a ratios, 340 whose data were added and calculated in two sub-sections, called "Uncertainty budget of 341 $\varepsilon_{p m}^{geo}/\varepsilon_{p a}^{geo}$ and "Uncertainty budget of COI_m/COI_a , respectively. 342

Values and combined uncertainties of ρ_a , $\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}$ and COI_m/COI_a were calculated together with sensitivity coefficients of the input quantities and their relative contribution; the matrix formalism was used to propagate the uncertainties via the correlation matrices R_{ρ_a} , $R_{\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}}$ and R_{COI_m/COI_a} .

347The analysis quantified $2.32(11) \times 10^{-10}$ g mL⁻¹ of Th, $2.096(99) \times 10^{-9}$ g mL⁻¹ of Cr,348 $6.89(96) \times 10^{-8}$ g mL⁻¹ of Ba, $4.01(39) \times 10^{-11}$ g mL⁻¹ of Sb, $5.06(15) \times 10^{-11}$ g mL⁻¹ of Sc,

 $\begin{array}{ll} 349 & 8.00(85)\times10^{-10}\ g\ mL^{-1}\ of\ Rb,\ 3.87(27)\times10^{-8}\ g\ mL^{-1}\ of\ Fe,\ 2.220(77)\times10^{-8}\ g\ mL^{-1}\ of\ Zn\\ 350 & \mbox{and}\ 3.24(31)\times10^{-11}\ g\ mL^{-1}\ of\ Co. \end{array}$

The uncertainty budgets are given in the developed MS excel file available in the Supplementary Information; cells dealing with informative or intermediate data were

- 353 grayed. In $\mathbf{R}_{\varepsilon_{p\,m}^{\text{geo}}/\varepsilon_{p\,a}^{\text{geo}}}$ and $\mathbf{R}_{\text{COI}_{\text{m}}/\text{COI}_{a}}$, we set the correlation coefficients of $a_{1}, a_{0}, a_{-1}, a_{-2}$
- and a_{-3} according to the data shown in Table 1; in addition, as a first attempt, in $R_{\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}}$,
- 355 we set to the unity value the correlation between $\delta \varepsilon_{ra}$ and $\delta \varepsilon_{rm}$, and in R_{COI_m/COI_a} , we set
- to the unity value the correlation between P/T_{γ} values, if existing.
- A survey of the main contributors to the combined uncertainties is given in Table 4 whilethe (complete) Cr budget is shown in the Supplementary Information.

Table 4 Main contributors to the combined uncertainty of the quantified elements. Input quantities, X_i , are explained in the text. The index I is the relative contribution of X_i

Т	ĥ	C	r	I	За	5	Sb	5	Sc	R	lb	F	Fe	Z	'n	0	Co
X _i	I / %																
$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	26.7	$n_{\mathrm{p}\mathrm{a}}$	35.3	$Q_{0 a}$	89.3	n _{pa}	77.6	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	49.3	$n_{ m pa}$	83.4	n _{pa}	78.0	$\frac{\text{COI}_{\text{m}}}{\text{COI}_{\text{a}}}$	33.1	n _{pa}	92.8
$n_{ m pa}$	25.1	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	27.4	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	3.2	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	8.0	v	16.0	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	3.5	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	7.9	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	32.6	$\frac{\varepsilon_{\rm pm}^{\rm geo}}{\varepsilon_{\rm pa}^{\rm geo}}$	4.1
$\frac{\text{COI}_{\text{m}}}{\text{COI}_{\text{a}}}$	16.1	$\frac{\text{COI}_{m}}{\text{COI}_{a}}$	17.6	n _{pa}	2.9	Q_{0a}	6.6	<i>w</i> _m	10.9	$\frac{\text{COI}_{\text{m}}}{\text{COI}_{\text{a}}}$	3.5	$\frac{\text{COI}_{\text{m}}}{\text{COI}_{\text{a}}}$	6.9	v	12.3		
Q_{0a}	12.0	v	6.5					Q_{0a}	5.8					<i>w</i> _m	8.4		
v	6.4	<i>w</i> _m	4.5					n _{pa}	4.1					Q_{0a}	4.1		

361 In summary, the uncertainty of the results was largely due to $\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}$, $n_{p\,a}$ and 362 COI_m/COI_a . In a few cases, v, w_m and m_m had an influence while the 20% uncertainty of 363 the $Q_{0\,a}$ recommended in the k_0 database [14] had the overriding effect for the 364 determination of Ba.

365 It is worth to observe that the contribution to $\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}$ due to possible differences in 366 counting positions of samples could be canceled if the monitor element was embedded in the analyte sample [18, 19]; this was confirmed by setting the correlation coefficient between Δd_{a} and Δd_{m} in $\boldsymbol{R}_{\varepsilon_{p}^{\text{geo}}/\varepsilon_{p}^{\text{geo}}}$ to the unity value.

Besides, the result of Co deserves attention. In this case, i.e. when the analyte corresponds to the monitor element and the same γ -emission is used, the k_0 -NAA turns into the relative-NAA. Accordingly, we set to the unity value the correlation coefficients between $t_{1/2}$, $t_{1/2}$. $k_{0 Au}$, Q_0 and \overline{E}_r in \mathbf{R}_{ρ_a} and between E_{γ} , a_{γ} , c_{γ} , P/T_{γ} in $\mathbf{R}_{\text{COI}_m/\text{COI}_a}$. As a result, the contributions due to the "intrinsic" uncertainty characteristic of the k_0 -NAA method [8] and due to the $\text{COI}_m/\text{COI}_a$ were reset; moreover, the correlation coefficients of a_1 , a_0 , a_{-1} , a_{-2} and a_{-3} in $\mathbf{R}_{\varepsilon_{p m}^{\text{geo}}/\varepsilon_{p a}^{\text{geo}}}$ made their contribution to $\varepsilon_{p m}^{\text{ext}}/\varepsilon_{p a}^{\text{ext}}$ zero as well.

376 **Conclusions**

The spreadsheet approach proved to be suitable to set up the uncertainty budget for the k_0 standardisation method in NAA when the majority of the recognized sources of error are considered and the measurement model is written to limit the correlations between input quantities. The use of the matrix formalism was straightforward to propagate the uncertainties by taking into account the covariances.

A MS excel file was developed and tested for the determination of Th, Cr, Ba, Sb, Sc, Rb, Fe, Zn and Co in a lyophilized CSF sample. The uncertainty budget of each element was compiled once the estimates, the uncertainties and the correlation coefficients associated with the input quantities were specified. The value and combined uncertainty of the result were calculated and the most overriding contributors were pointed out.

387 It was shown that when the monitor element corresponded to the analyte element and the 388 same γ -emission was used, the worksheet set up the uncertainty budget for the relative-389 NAA method; this makes the proposed approach applicable either in the relative- and k_0 -390 NAA.

391 The MS excel file is open and free available to users. The implemented measurement model392 allows a broad application, e.g. in case of different sample material, monitor element,

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neutron irradiation and γ -spectrometry conditions. The extension to other elements is possible by a simple duplication of the existing worksheets; only the modification of the formulae adopted to compute the COI_m/COI_a ratio might be required for other decay schemes.

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- 440 Supplementary information
- 441 Developed worksheet file
- 442 See the MS excel file "uncertainty_k0_spreadsheet.xlsx"
- 443 Uncertainty budget of Cr

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The (complete) uncertainty budget of the Cr determination is here reported. According to Table 1, the most overriding contributors to the combined uncertainty were n_{pa} (35.3%), $\varepsilon_{pm}^{geo}/\varepsilon_{pa}^{geo}$ (27.4%) and $\text{COI}_{m}/\text{COI}_{a}$ (17.6%). The remaining 19.7% was due to v, w_{m} , $Q_{0a}, m_{m}, k_{0Au}(a), k_{0Au}(m), Q_{0m}, n_{pm}, \alpha$ and f, in decreasing order of importance. As regards to $\varepsilon_{pm}^{geo}/\varepsilon_{pa}^{geo}$ (see Table 2), the main contributors were a_1, a_{-1}, a_{-2} (44.0%), Δd_{a} (25.6%) and Δd_{m} (31.5%), while the uncertainty of $\text{COI}_{m}/\text{COI}_{a}$ (see Table 3) was due to $P/T_{\gamma 2 m}$ (96.1%).

451 The a_0 value is not affecting $\varepsilon_{p\,m}^{geo}/\varepsilon_{p\,a}^{geo}$. In fact, a_0 in equation (6) models a constant 452 multiplying factor that is deleted from the detection efficiency ratio. In addition, since we 453 considered $\Delta d_a = \Delta d_m = 0$ mm, the contribution of $\delta \varepsilon_{r\,a}$ and $\delta \varepsilon_{r\,m}$ was reset.

Table 1 Uncertainty budget of the mass concentration of Cr in the lyophilized CSF sample. Quantities are explained in the text. The column Index gives the relative contribution of the input quantity, X_i , to the output quantity, Y. Values of the sensitivity coefficient, c_i , and Index are omitted for those quantities that are not actual inputs of the measurement model.

Quantity	Unit	Value	Std. Uncertainty	Sens. Coeff.	Index
X _i	$[X_i]$	x_{i}	$u(x_i)$	Ci	I / %
t _i	s	$2.1600 imes 10^4$	$1.7 imes 10^1$	$3.0 imes 10^{-16}$	0.0
μ	1	$4.45 imes 10^{-2}$	$5 imes 10^{-4}$	$\textbf{-1.0}\times10^{\textbf{-10}}$	0.0
t _{1/2 a}	s	2.39328×10^{6}	$2.1 imes 10^2$	$1.1 imes 10^{-16}$	0.0
λ_{a}	s ⁻¹	$2.89622 imes 10^{-7}$	$2.5 imes 10^{-11}$		
<i>t</i> _{1/2 m}	s	1.66346×10^{8}	$2.6 imes 10^4$	$-1.2 imes 10^{-17}$	0.0
$\lambda_{ m m}$	s ⁻¹	$4.16690 imes 10^{-9}$	$6.5 imes 10^{-13}$		
t _{d a}	S	$2.404405 imes 10^{6}$	$3.5 imes 10^1$	$6.1 imes 10^{-16}$	0.0

$2.9 imes 10^{-1}$ $3.6 imes 10^{-16}$ $1.29262800 imes 10^{6}$ S t_{ca} $2.9 imes 10^{-1}$ $1.26426800 imes 10^{6}$ -1.7×10^{-15} 0.0 s t_{la} s 3.722775×10^{6} $3.5 imes 10^1$ -8.7×10^{-18} 0.0 $t_{\rm d\,m}$

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t _{cm}	s	$7.9700 imes 10^2$	$2.9 imes 10^{-1}$	$-1.1 imes 10^{-13}$	0.0
t _{lm}	s	$7.400 imes 10^2$	$2.9 imes 10^{-1}$	$2.9 imes 10^{-12}$	0.0
δ_{a}	1	1.022	0.000		
δ_{m}	1	1.077	0.001		
ξa	1	1.00098	1×10^{-5}		
$\xi_{\rm m}$	1	1.00319	4×10^{-5}		
n _{pa}	1	$5.26 imes 10^4$	$1.5 imes 10^3$	$4.0 imes 10^{-14}$	35.3
n _{p m}	1	1.3749×10^5	4.4×10^2	$-1.5 imes 10^{-14}$	0.5
k _{o Au} (a)	1	$2.620\times10^{\text{-3}}$	$1.3 imes 10^{-5}$	$-8.0 imes 10^{-7}$	1.1
$k_{0 Au}(m)$	1	1.3200	$5.3 imes 10^{-3}$	$1.6\times10^{\text{-9}}$	0.7
$G_{\mathrm{th}\mathrm{a}}$	1	1.000	0.000	$-2.0 imes 10^{-9}$	0.0
G _{ea}	1	1.000	0.000	$\textbf{-7.7}\times10^{\textbf{-11}}$	0.0
G _{th m}	1	1.000	0.000	$1.8\times10^{\text{-9}}$	0.0
G _{e m}	1	1.000	0.000	2.7×10^{10}	0.0
f	1	$1.560 imes 10^1$	$3.3 imes 10^{-1}$	$\textbf{-}1.2\times10^{\textbf{-}11}$	0.2
α	1	-3.60×10^{-2}	$6.4 imes 10^{-3}$	$\textbf{-9.0}\times10^{\text{-10}}$	0.3
Q_{0a}	1	$5.3 imes 10^{-1}$	$1.1 imes 10^{-1}$	$\textbf{-1.8}\times10^{\textbf{-10}}$	3.6
Ē _{ra}	eV	$7.53 imes 10^3$	$8.3 imes 10^2$	$\textbf{-8.7}\times10^{\textbf{-17}}$	0.0
$Q_{0a}(\alpha)$	1	$5.9 imes10^{-1}$	$1.5 imes 10^{-1}$		
Q _{0 m}	1	1.993	$6.0 imes10^{-2}$	$1.4 imes 10^{-10}$	0.7
Ē _{rm}	eV	1.360×10^2	6.9	$5.8\times10^{\text{-}14}$	0.0
$Q_{0 \mathrm{m}}(\alpha)$	1	2.319	$9.5 imes 10^{-2}$		
$arepsilon_{ m pm}^{ m geo}/arepsilon_{ m pa}^{ m geo}$	1	$3.507 imes 10^{-1}$	$8.7 imes 10^{-3}$	$6.0 imes10^{-9}$	27.4
COI _m /COI _a	1	$8.57 imes 10^{-1}$	$1.7 imes 10^{-2}$	$2.4 imes 10^{-9}$	17.6
$m_{ m m}$	g	8.47×10^{-3}	$5 imes 10^{-5}$	$2.5 imes 10^{-7}$	1.6
m _a	g	$2.4000\times10^{\text{-1}}$	5×10^{-5}	$-8.7 imes 10^{-9}$	0.0
<i>w</i> _m	g g ⁻¹	4.597×10^{-3}	$4.6 imes 10^{-5}$	4.6×10^{-7}	4.5
v	mg L ⁻¹	99.2	1.2	-2.1×10^{-11}	6.6
Y	[Y]	у	$u_{\rm c}(y)$		
ρ _a	g mL ⁻¹	2.096×10^{-9}	9.9×10^{-11}		

0.0

Table 2. Uncertainty budget of the $\varepsilon_{p m}^{geo} / \varepsilon_{p a}^{geo}$ ratio given in Table 1.

Quantity	Unit	Value	Std. Uncertainty	Sens. Coeff.	Index
X_{i}	$[X_i]$	x_{i}	$u(x_{\rm i})$	Ci	1/%
<i>a</i> ₁	MeV ⁻¹	-4.72×10^{-1}	4.3×10^{-2}	3.0×10^{-1}	74.1

-					
a_0	1	-3.229	$5.7 imes 10^{-2}$	0.0	0.0
<i>a</i> ₋₁	MeV	$4.03 imes 10^{-1}$	$2.0 imes 10^{-2}$	-8.0×10^{-1}	-43.1
a_2	MeV ²	3.20×10^{-2}	2.2×10^{-3}	-3.2	13.0
a_3	MeV ³	5.73×10^{-4}	$7.5 imes 10^{-5}$	-1.0×10^{1}	-1.1
E _{γm}	MeV	1.17320	1.2×10^{-4}	-2.5×10^{-1}	0.0
Eγa	MeV	3.2010×10^{-1}	1.2×10^{-4}	9.2×10^{-1}	0.0
Δd_{a}	mm	0.00	0.29	1.5×10^{-2}	25.6
$\Delta d_{ m m}$	mm	0.00	0.29	-1.7×10^{-2}	31.5
e_4	keV ⁻⁴	-7.10×10^{-11}	$0.00 imes 10^{-11}$		
<i>e</i> ₃	keV ⁻³	$5.19 imes 10^{-8}$	$0.00 imes 10^{-8}$		
<i>e</i> ₂	keV ⁻²	-1.43×10^{-5}	$0.00 imes 10^{-5}$		
e_1	keV ⁻¹	1.78×10^{-3}	0.00×10^{-3}		
e_0	1	-4.46×10^{-2}	0.00×10^{-2}		
d_1	keV ⁻¹	5.56×10^{-6}	$0.00 imes 10^{-6}$		
d_0	1	4.17×10^{-2}	$0.00 imes 10^{-2}$		
$\delta \varepsilon_{\rm ra}$	mm ⁻¹	4.3×10^{-2}	5×10^{-3}	0.0	0.0
$\delta \varepsilon_{\rm rm}$	mm ⁻¹	4.8×10^{-2}	6 × 10 ⁻³	0.0	0.0
Y	[Y]	у	$u_{\rm c}(y)$		
$\varepsilon_{ m pm}^{ m geo}/\varepsilon_{ m pa}^{ m geo}$	1	$3.507 imes 10^{-1}$	8.7×10^{-3}		

Table 3 Uncertainty budget of the COI_m/COI_a ratio given in Table 1. (*) Notation reported in [4] and adopted for the cascade scheme.

Quantity X.	Unit $[X_i]$	Value	Std. Uncertainty $u(x)$	Sens. Coeff.	Index
a_1	MeV ⁻¹	-4.72×10^{-1}	4.3×10^{-2}	-1.9×10^{-1}	5.9
a_0	1	-3.229	$5.7 imes 10^{-2}$	-1.4×10^{-1}	-4.9
<i>a</i> ₋₁	MeV	$4.03 imes 10^{-1}$	$2.0 imes 10^{-2}$	-1.1×10^{-1}	1.0
a_2	MeV^2	3.20×10^{-2}	2.2×10^{-3}	-8.0×10^{-2}	-0.1
a_3	MeV ³	5.73×10^{-4}	$7.5 imes 10^{-5}$	-6.0×10^{-2}	0.0
<i>b</i> ₁	1	-0.571	0.000		
b_0	1	1.079	0.000		
<i>C</i> ₂	1	-1.625	0.000		
<i>c</i> ₁	1	6.678	0.000		
C ₀	1	-7.006	0.000		
$E_{\gamma 2 m}$	keV	1.3325×10^3	$1.2 imes 10^{-1}$	$9.6 imes 10^{-5}$	0.0
$a_{\gamma 2 m}$	1	1.000	0.012	-1.4×10^{-1}	0.9
$c_{\gamma 2 m}$	1	1.000	0.012	-1.4×10^{-1}	0.9
$P/T_{\gamma 2 \text{ m}}$	1	0.197	0.023	$7.3 imes 10^{-1}$	96.1

Y	[Y]	у	$u_{\rm c}(y)$	
COI _m /COI _a	1	$8.57 imes 10^{-1}$	1.7×10^{-2}	

466	This section will not appear in the printed version of your paper but it will contain a link;
467	the webpage containing the electronic supplementary information will appear when one
468	clicks on the hyperlink. Here you can list the details of your research which would be too
469	long for the main text, e.g. a larger number of spectra etc. Start with 1 for Figure and Table
470	numbers in this section.